

A55
1:1944
c.2

North Carolina State Library
Raleigh


RESEARCH AND FARMING

SIXTY-SEVENTH ANNUAL REPORT

Agricultural Experiment Station
North Carolina State College of
Agriculture and Engineering of
The University of North Carolina

1944





Digitized by the Internet Archive
in 2012 with funding from
LYRASIS Members and Sloan Foundation



RESEARCH AND FARMING 1944

I. O. Schaub, *Dean of Agriculture*

L. D. Bayer, *Associate Dean of Agriculture and
Director, Agricultural Experiment Station*

SIXTY-SEVENTH ANNUAL REPORT

Agricultural Experiment Station
North Carolina State College of
Agriculture and Engineering of
The University of North Carolina
Fiscal Period July 1, 1943-June 30, 1944
Progress Report for Dec. 1, 1943
To Nov. 30, 1944, Raleigh

STATE INSTITUTIONS COOPERATING IN AGRICULTURAL RESEARCH

State College of
Agriculture and Engineering
Of The University of North Carolina

Frank P. Graham, *President*
J. W. Harrelson, *Dean of Administration*
I. O. Schaub, *Dean of Agriculture*

N. C. Department of Agriculture
Raleigh, N. C.

W. Kerr Scott, *Commissioner*
F. E. Miller, *Director of Branch Stations**

* The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

CONTENTS

	PAGE
AGRICULTURAL ENGINEERING	9
EXPERIMENTAL - STATISTICS	12
FIELD CROPS	15
Tobacco	15
Corn	18
Cotton	26
Pastures and Forage	31
Peanuts and Soybeans	37
Small Grains	50
FORESTRY	55
HORTICULTURAL CROPS	57
Small Fruits	57
Truck Crops	59
Peaches	67
Flowers and Nursery	68
LIVESTOCK AND POULTRY	70
Beef Cattle	70
Dairying	73
Hogs	76
Sheep	78
Turkeys and Poultry	79
Nutrition	83
ECONOMIC AND SOCIAL PROBLEMS	86
Economic Problems	86
Social Problems	91
SOILS AND FERTILIZERS	94
Soil Conservation	94
Fertilizers	95
PUBLICATIONS	99
OFFICERS AND STAFF	105
FINANCIAL STATEMENTS	109

To the Governor of North Carolina, the Board of Trustees and President of the University of North Carolina and the Chancellor of the North Carolina State College of Agriculture and Engineering:

I am transmitting herewith the report of the Agricultural Experiment Station for the year ending June 30, 1944.

Respectfully submitted,

L. D. Baver

Director,
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION.



NEW EQUIPMENT

Development of Machines for Distributing Liquid Forms of Nitrogen

Previous work has indicated the possibility of using liquid forms of nitrogen for top dressing purposes. But part of the problem of conducting field trials with these forms of nitrogen was the development of a machine that would be satisfactory for the purpose. The Tennessee Valley Authority had designed and made an unusual pump for metering the nitrogen solution. The Agricultural Engineering Department secured one of these pumps and made a part of a distribution unit. In trial perform-

ances, this machine was found to deliver uniform amounts of the solution, regardless of the speed of operation, as it is geared to the ground wheels, and increased miles per hour will increase the rotation of the pump. The machine is relatively simple, very compact and in general thoroughly satisfactory. The weakness seems to be that the rubber tubes may require frequent replacement.

A machine previously developed by a commercial concern was also obtained and tried. Its distinguishing feature is the use of a gear pump for metering the material. The chief disadvantage of the machine tried was

FIG. 1. GRAVITY FEED LIQUID FERTILIZER DISTRIBUTOR DEVELOPED AT THE NORTH CAROLINA STATION.

that it could handle only one row at a time and, more important, the corrosive action of the material affected the metal of the pump. It was felt that both of these objections could be overcome.

In an attempt to reduce the cost of the machine to the farmer, a gravity feed type was developed to be transported on a truck body. (Fig. 1.) The metering was to be accomplished by the size and number of holes in the distribution system. Due to the difference in head between a tank which was full of liquid and one approaching an empty condition, greatly varying rates of distribution were secured. Further consideration of this problem resulted in the development of a "constant pressure gravity feed," which was fairly satisfactory. Because of the low expense in the construction of such a machine on a farm where a farm truck is obtainable, it is felt that

with further work this machine can be made to serve the purpose.

Coal Stokers for Heating Tobacco Barns

The scarcity of wood and the shortage of labor have focused attention on the use of domestic coal stokers for curing tobacco. (Fig. 2.) A three-year study of the use of stokers has shown: First, there is a tendency to use over-size equipment. Second, a special design of the furnace for stoker use is desirable. Third, most barns have insufficient flue surface. Fourth, proper regulation of the draft is necessary for best economy and satisfaction.

A 30-pound per hour stoker is adequate for an ordinary four-room barn, while a five-room barn will require a 40-pound stoker. Stokers larger than needed result in poor fuel economy. Desirable features for a stoker for tobacco curing are a long feed screw, a small retort, two or three speeds of coal feed, and an accessible clean-out box.

A special furnace having an arch of the correct design has been worked out. It requires the use of some fire brick and some common brick as well as a cast iron thimble for the flue eye. (Request Plan 8020 if interested in this furnace.)

The flue surface should provide approximately one square foot for each square foot of floor area. Too much is better than too little, and a four-room barn should have a minimum of 70 feet of twelve-inch flue and a five-room barn at least 110 feet of the same sized flue. The use of a specially designed heating jacket over the first two or three joints of flue pipe will prove very beneficial. This jacket can be built on the job and is simple to make and install.

Two methods of controlling the



FIG. 2. A TYPICAL STOKER INSTALLATION.

stoker have been perfected: one, the simple time clock having a 15-minute cycle and being capable of operating the stoker as much as ten minutes out of each fifteen. The other is the ordinary thermostatic control. Of these, the time clock has proved the best because, 1. It gives an excellent control of the fire during the period of yellowing. 2. It provides an automatic rise of temperature as the leaf dries, thus requiring less attention. 3. It establishes an even drying rate both night and day. 4. It is the least expensive and the most dependable.

Other results obtained in this experiment indicate the desirability of a carefully constructed and well insulated barn. Commerical insulation, as well as aluminum foil and even so simple a treatment as painting the walls with proper colored paint have all given the desired result in economy of fuel consumption.

Progress in Harvesting Sweet Potato Vines

Experimental work is being continued in developing a machine that

will harvest the vines of sweet potatoes for silage and will economically and mechanically fit into the farming system.

There are four possible types of machines if it is assumed that all the vines are to be utilized and that the potatoes are to be grown in ridged rows. These types are: (1) Raking and dumping, (2) windrowing, (3) continuous removing of the vines and elevating them into a wagon, and (4) continuous removing of the vines, chopping and elevating the chopped material into a wagon.

An experimental machine of type 2 called the "vine-row I" was developed at the Station. This machine pulled by two horses will remove the vines and place them in a continuous windrow on top of the ridged row. It does no damage to potatoes unless they protrude above the surface of the soil. After windrowing the vines may be: (1) Loaded from the windrow by fork, (2) raked into bunches and loaded by fork, or, (3) picked up by a commercial pickup chopper for silage.



GROWTH OF DEPARTMENT

Regional Institute of Statistics

The Department of Experimental Statistics was organized at State College in January, 1941, and immediately the staff began (1) to provide computational services to the Agricultural Experiment Station (Fig. 3), (2) to give advice on planning experiments and analyzing data, (3) to conduct fundamental research in statistical methodology and application, and (4) to teach courses in applied and mathematical statistics.

The demand for the statistical services of the Department has increased rapidly, with a large number of requests for assistance coming from

other research agencies, especially from those handling southern research projects. This demand for regional as well as local assistance has led to the organization of the Institute of Statistics which has received supplementary financial support from the General Education Board founded by John D. Rockefeller. The additional staff and facilities thus provided will also increase the efficiency of the services available to the local Agricultural Experiment Station research workers.

Computational Service

The Department of Experimental Statistics is primarily a service de-

FIG. 3. ONE OF THE DEPARTMENT'S COMPUTING ROOMS.

partment for scientists, and therefore the results of its research are seldom of direct interest to the farmers of the State. However, the work serves indirectly to insure that all experiments of the Station are planned and conducted in the best possible manner.

The Department analyzes practically all the data gathered by the Station workers. Hence, the very best statistical techniques may be used, even if such techniques involve complicated designs or long computations. About 750 different sets of data have been analyzed during the past year and many more have been summarized. Most of the results given in this annual report are based upon experimental data evaluated by using the best statistical methods known at present.

Consultant Service

Consultant service offered by the Department consists of helping plan experiments in such a way that the most information on the problems being investigated will be obtained with the least expenditure of time, labor, and materials. Most of the assistance of the Department has been given to two general groups of workers.

(a) Members of the North Carolina Experiment Station Staff. As an example of what is being accomplished through the consultant service, an experiment to provide information on the vitamin B₂ content of soybeans was recently conducted by the Animal Industry Department. Using an experimental design recommended by the statisticians, the results showed the information obtained by that method to be as accurate as results obtained from the use of four times as many experimental animals by methods employed heretofore. Thus, the labor required was about half

what would have been required otherwise.

(b) The Southern Cooperative Group. This group was organized in 1938 to make a coordinated study of the effects of soil fertility and other environmental factors on the nutritive value of vegetables. Its membership includes one or more persons from the staffs of most of the Southern Experiment Stations, and North Carolina workers are particularly active in the work. Early in the year this organization requested consultant service from the Experimental-Statistics Department. The service was begun in June, and to date, statistical analyses and interpretation of the data from research projects on tomatoes, sweet potatoes, and lima beans have been furnished. Also, consultant assistance has been furnished in the planning of new projects on nutritive losses in large-scale cooking, the vitamin A and C content of certain sweet potato varieties that are affected by environment, and the factors influencing the vitamins B₁, B₂, and C content of lima beans.

Plant and Animal Science Work Conferences

The Department conducted a work conference in February dealing with problems of experimental designs, analysis of data, and interpretation of results in the field of plant science investigation. Twelve of the leading men in plant breeding, soils, and horticulture in the southeast were invited to attend. Nine men from this Station participated and four statisticians from other laboratories were brought in to assist with the week's work.

A conference for research workers in the fields of animal, dairy, and poultry science was held in October, 1944. Basic instruction in statistical methods and experimental design was given and specific problems in the

conduct of experiments with animals were discussed. The objective, as always in the field of applied statistics, was to show how experiments can be planned to yield maximum information for the time and labor expended. The conference was attended by Experiment Station workers from North Carolina and nine other states and by representatives of the Office of Experiment Stations and Bureau of Animal Industry of the USDA.

Cooperation With Bureau of Agricultural Economics

Cooperative research projects with the Bureau of Agricultural Economics covered a wide range of subjects. The use of control information and improved mathematical procedures for eliminating the effects of selectivity in mailed questionnaires were investigated in the fields of farm employment, milk production, production and sales of farm butter, farm prices, and crop acreages. The suitability of sample data for the preparation of county estimates was tested for sample data collected by the North Carolina Crop Reporting Service and sample data collected for the Southern Region by the AAA. The AAA samples were 10 per cent of Farm Plan records for every county and state in the Southern Region.

Results indicate that mailed questionnaires yield accurate results for many items when properly analyzed. Sample data from mailed questionnaires now collected by the Crop Reporting Service are not adequate for county estimates, chiefly because the samples are too small. Accurate county estimates of crop acreage were obtained from the 10 per cent samples of AAA and Farm Plans in the Southern Region but difficulties were encountered with the livestock estimates in range country.

Data collected by the USDA on Farm Labor supply and demand as the percentage of normal were found to be highly correlated with number of farm workers and number of persons potentially available for farm work. Joint effects of supply and demand must be taken into account in interpreting these data.

Some aspects of sample design were also investigated. Mathematical methods were developed for estimating the loss in precision introduced by enumerating groups of neighboring farms instead of individual farms taken at random. Efficiencies of counties as sampling units for estimating state totals were investigated and found to be high when proper methods of estimating were used. N. C. State Farm Census records were studied to estimate changes in the number of active farms in North Carolina.



TOBACCO

Oxford 26, a Tobacco Variety Resistant to Granville Wilt

The new variety of tobacco developed from hybrids of tobacco introduction 448A x 400 has been made available for use in the 1945 crop under the name of Oxford 26 (Fig. 4).

In extensive trials it was highly resistant to wilt, produced a satisfactory yield and was found suitable for cigarette manufacture as shown by quality tests. Seed for approximately 40,000 acres of tobacco were produced by certified growers from foundation stocks supplied by the Tobacco Branch Station.

18- to 24-Inch Spacing Best

There is a little difference between the yield and total value per acre when tobacco is planted at different

distances in the row. However, after a study of this problem for several years, the conclusion would be that tobacco planted in 4-foot rows and between 18 inches and 24 inches apart on the drill will give the best results. Using 1,200 pounds of 3-9-6 per acre, the value per acre for 12-, 18-, 24- and 36-inch plants were \$647.40, \$622.71, \$626.75 and \$508.95, respectively.

Tests Show Topping Profitable

It is obvious that reasonably high topping, and keeping the suckers off the tobacco will prove to be profitable year after year.

In 1942 tobacco that was topped 16 leaves high with the suckers pulled produced a little over 200 pounds more tobacco, bringing approximately \$135 more per acre, than that not topped.

FIG. 4. A FIELD OF OXFORD 26 GROWING ON SOIL WHERE GRANVILLE WILT HAD DESTROYED NINE PREVIOUS CROPS OF TOBACCO.

In 1944 the difference in favor of the tobacco topped 16 leaves with 800 pounds of 3-9-6 fertilizer was 164 pounds and \$73.12 per acre. With 1,200 pounds of the same fertilizer, the difference was 85 pounds and \$39.83 per acre in favor of the topping.

There is no question but that it is profitable to top the tobacco as soon as the terminal bud gets long enough to break out without injury to the top leaves and then keep the suckers off the tobacco. The additional growth should go into the leaves and not in the top or suckers.

Yields Increased by Heavier Fertilization But Quality Slightly Poorer

Heavier fertilization has given some increase in returns from tobacco during 1944. This was brought about largely by the increase in yield as is indicated in the following table. Six standard and improved varieties were fertilized at three different rates, 1,000, 1,350 and 1,700 pounds per acre. The composite yield and value was as follows:

Fertilizer	Yield per A.	Value per A.
1,000 lbs. 3-9-6	1,421 lbs.	\$651.91
1,350 lbs. 3-9-6	1,546 lbs.	\$709.72
1,700 lbs. 3-9-6	1,594 lbs.	\$741.61

The new varieties (The 400 series) responded more readily to heavier applications of fertilizer than did the older varieties, also, they had less leaf spot. Judging by the grades, however, seems to indicate that the quality of the tobacco grown on the 1,000 pounds and 1,350 pounds fertilizer per acre was slightly better than that from 1,700 pound applications.

New Varieties Make Important Contribution to Increased Yields

The increase in average acre yield of tobacco in North Carolina for the past few years has been brought about

by increased planting of improved varieties, better cultural methods and fertilization. Table 1 gives a summary of the results of variety tests for the past seven years on all except the 402 variety which has not been developed long enough to be included in a seven-year test.

TABLE 1
Summary of Results of Varieties
1937, 1939-1944

Variety	Av. Yield per acre	Av. Value per acre
	Lbs.	Dollars
402 (1942-1944)	1,586	687.01
400	1,469	434.79
401	1,452	432.89
Gold Dollar	1,304	424.96
White Stem Orinoco	1,354	409.39
Jamaica	1,328	397.71
Bonanza	1,346	397.60
Va. Bright Leaf	1,364	375.08
Cash		
(not planted 1943)	1,209	306.92

Tobacco Blackshank

Over 8,000 acres of blackshank resistant tobacco were grown in 1944 according to county agents of the Extension Service. This is a substantial increase over the acreage grown in 1943 and reflects the usefulness of these varieties in tobacco culture. Oxford strains 1 and 3 were grown much more extensively than strains 2 and 4.

Blackshank has spread continuously since it was first reported in Forsyth County in 1930. It now occurs in 14 counties which grow over one-fourth the North Carolina acreage. Other diseases, particularly Granville wilt and black root rot, occur in much of this area. Hence, growers who consider changing to a disease resistant variety should as a first step determine the disease to be controlled because the varieties now available are resistant to single diseases and not to all diseases that attack the crop.

Dust Treatment for Tobacco Blue-Mold Control

As a result of work by other State Agricultural Experiment Stations and the Division of Tobacco Investigations of the USDA, a promising dust treatment has been developed for blue mold control.

At two locations in 1944 Fermate dusts gave effective control when applied in a twice weekly schedule. Pyrax and Fuller's Earth were satisfactory diluents in mixtures containing 15 per cent Fermate. The data indicated that degree of blue mold control was determined by thoroughness of application and amount of dust used. Fermate spray at the rate of three pounds per 100 gallons of water gave excellent control in supervised commercial trials.

Use of Cyanamid and Uramon on Tobacco Plant Beds

Control of soil-borne diseases and elimination of weeds are two problems that must be met by chemical treatments on plant bed soils. In tests conducted over a period of several years Cyanamid or Uramon at the rate of 1 pound per square yard has effectively reduced the number of weed seedlings on plant beds (Fig. 5).

This rate of Uramon also gave control of root knot and Granville wilt while Cyanamid was ineffective against these diseases. To lessen the disease hazard, growers who use Cyanamid for weed control are advised to use new plant bed sites each year.

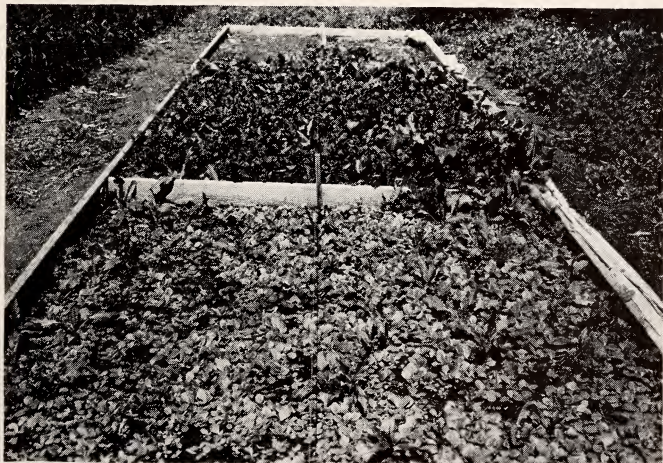


FIG. 5. WEED CONTROL ON TOBACCO PLANT BED BY CHEMICAL TREATMENT. FRONT: THIS PLOT WAS TREATED THE PRECEDING FALL WITH ONE POUND OF URAMON PER SQUARE YARD. BACK: THIS PLOT RECEIVED NO TREATMENT.

CORN

Good Corn Hybrids Better Than Best Varieties

The majority of the several hundred farmers who in 1944 grew corn hybrids to compare with open pollinated varieties, report the best adapted hybrids to be at least 25 per cent better than the varieties (Fig. 6).

R. A. Crowell, Enka, produced 70 bushels per acre of the hybrid U. S. 282 as compared to 52 bushels per acre for Penland, his old variety. T. M. Jenkins, Robbinsville, measured 108 bushels per acre for N. C. Hyb. T20F as compared to 79 bushels for Holcombes Prolific. N. C. Hyb. 1028 produced 50 bushels per acre in contrast to 39 bushels for the variety on D. E. Trantham's farm, Reidsville. Lee Bridgers, Macclesfield, reports over 80 per cent of the plants of N. C. Hyb. 1032 standing erect at harvest time in spite of the heavy wind storm which caused much of his old variety to blow down. The hybrid yielded 48 bushels as compared to 37 bushels per acre for the variety.

These examples are typical of many reports received from farmers. On the other hand, there are cases where the hybrid strain grown failed to surpass the check variety. Because of these unfavorable cases, farmers should try more than one corn hybrid strain before deciding on which strain should be used for their entire crop.

Hybrid Seed Production Increased

One hundred and sixty farmers working through their North Carolina Crop Improvement Association co-operated in growing 3,000 bushels of hybrid corn seed in 1944.

Even though extreme weather conditions and heavier than usual insect pest infestation reduced the seed yield



FIG. 6. A GROUP OF FARMERS AND AGRICULTURAL WORKERS LOOKING OVER SOME OF THE HYBRID CORN EARS THEY HAVE PULLED FROM THE FIELD IN THE BACKGROUND. THIS PICTURE WAS TAKEN ON H. E. DUNCAN'S FARM, BURNSVILLE. THE GROUP ESTIMATED THE HYBRIDS TO BE 25 PER CENT HIGHER YIELDING THAN THE VARIETY, U. S. 282 HAD THE HIGHEST YIELD OF THE HYBRIDS GROWN IN THIS FIELD.

by 25 per cent, this hybrid seed should plant nearly 1 per cent of the corn land in 1945. This quantity of seed represents a six-fold increase in the hybrid strains released by the Experiment Station over what was available in 1944. In addition to this locally grown seed, some seed of adapted hybrids will be available from out-of-state sources.

Foundation single-cross seed supplies for making the Station hybrids were increased (Fig. 7) as much as possible under the adverse seasonal conditions prevailing in 1944. Farmers will be able to plant four times as much acreage to the production of hybrid seed in 1945 as in 1944 but this acreage is still far short of that needed to supply the demand. Therefore, every effort will be made to increase the supply.

Time of Planting a Southern Advantage

Fortunately, corn production is not seriously reduced by being planted either before or after cash crops on the farm. However, seasonal variations in rainfall distribution from one season to the next govern which date or time will be best and since the weather cannot be forecast in advance, the farmer must gamble as to how the rainfall will be distributed.

In most years early planted corn receives more water at the critical stage of growth than does that planted late. However, in years like 1944 corn planted medium late received the most rainfall at its critical period. In the Coastal Plain during 1943 and 1944, the crops planted between April 1 and June 1 produced approximately the same average yields. Planting later than June 1 resulted in reductions in grain yield up

to 45 per cent. Such late plantings usually are affected by droughts in late summer and heavy infestations of insect pests.

In the Piedmont very great reductions in yield of corn results from delaying planting after May 15. A two-year average shows yields of 100, 81, and 51 per cent for crops planted April 25, May 12, and June 4.

Hybrid strains differ in their response to time of planting. In general, late maturing strains produce better when planted early, while early maturing strains may do proportionally better when planted in mid-season (Fig. 8). All strains are reduced in yield by late planting.

Corn Strains Show Resistance to Insect Pests

Earworm Damage

In June, before the plants have tasselled, some corn strains show con-

FIG. 7. AN ISOLATION FIELD IN WHICH FOUNDATION SINGLE-CROSS SEED IS BEING PRODUCED. THE TWO CENTER ROWS WITH TASSELS PULLED ARE THE INBRED LINE NC7 BEING USED HERE AS THE SEED BEARING PARENT. THE TWO OUTSIDE ROWS SEEN WITH TASSELS ARE THE INBRED LINE NC13 BEING USED AS THE POLLEN PARENT. THE SINGLE CROSS PRODUCED IN THIS FIELD WILL BE USED IN MAKING THE DOUBLE CROSSES N. C. 1028 AND N. C. 1032.





FIG. 8. EAR SAMPLES TAKEN FROM THE DATE-OF-PLANTING STUDY AT THE PIEDMONT STATION, 1944. UPPER: A MEDIUM LATE HYBRID, N. C. 1032, WHICH PRODUCED BEST WHEN PLANTED EARLY. YIELDS RESPECTIVELY BY DATES WERE 100, 87 AND 44 PER CENT. LOWER: A MEDIUM EARLY HYBRID, U. S. 13, WHICH PRODUCED BEST WHEN PLANTED AT MID-SEASON. YIELDS WERE 100, 117, AND 67 PER CENT, RESPECTIVELY, FOR DATES EARLY TO LATE.

siderable damage to the young leaves caused by earworms. In the nursery in 1943, inbreds NC3 and NC7 showed more than 90 per cent of the plants with leaf injury, whereas NC5 and NC12 had less than a fourth of the plants injured.

The amount of damage earworms cause on the ears of field corn varies with the hybrid strain grown. In 1944 sixteen hybrids were studied for the

amount of damage caused by earworms. Hybrids of inbreds CI. 7, NC39, NC13, NC24, and NC34 all showed much less than average amount of damage. Hybrids of inbreds Ind. 38-11, NC16, NC60, and K4 showed more than average damage (Fig. 9). The character of the husks over the ear has an important relationship to the amount of damage caused by earworms. Long, tight

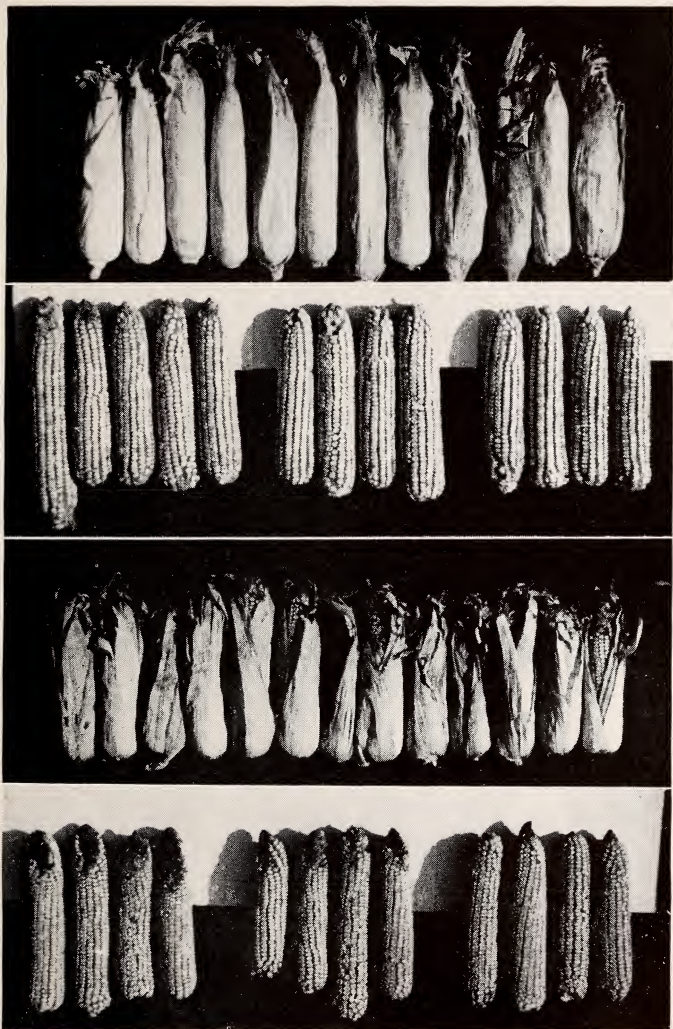


FIG. 9. EAR SAMPLES TAKEN FROM MCCULLERS EXPERIMENT STATION IN 1944. UPPER TWO ROWS: HYBRID OF NC34 SHOWING GOOD HUSK CHARACTERISTICS AND SMALL EARWORM DAMAGE. EARS GRADED IN 0, 1 AND 2 GRADES OF DAMAGE. LOWER TWO ROWS: HYBRID OF IOWA OS426 SHOWING POOR HUSK CHARACTERISTICS AND SEVERE EARWORM DAMAGE. EARS GRADED IN 1, 3, AND 4 GRADES OF DAMAGE.

husks help protect the grain, but other factors, at present unknown, also contribute to the resistance shown by some strains.

Grain Weevil Damage

The group of ears studied for earworm damage was also studied for the amount of damage caused to the grain by grain weevil (here used in the broad sense to include all stored grain insect pests). Hybrids of inbreds Ind. WF9, NC45, NC24, and CI. 7 showed very little damage, while those of inbreds Ind. 38-11, NC18, Hys and K4 showed extensive damage. On the basis of this study, there is no clear evidence that the character of the husk or texture of the kernel is related to the damage caused by these insect pests.

Greater Corn Stalk Borer

This insect is not as widely known

as the above species, but is common in Eastern North Carolina. It has caused serious damage to breeding strains and in 1943, counts showed only 17 per cent of the plants of NC7 free of borer damage. NC45 showed 64 per cent of plants free from borer damage. In 1944, in an increase planting where NC16 and NC18 were planted in alternate rows, the plants with borers were 44 and 66 per cent, respectively, for the inbred lines. These counts were made in June and include only the first generation borers. Borer injury, along with drought, caused a complete failure in this field.

Yields Increased 88 Bushels per Acre By Fertilization

On a Norfolk sandy loam under good rainfall conditions, the per acre yields of corn were increased from 19 bushels were no nitrogen was used to

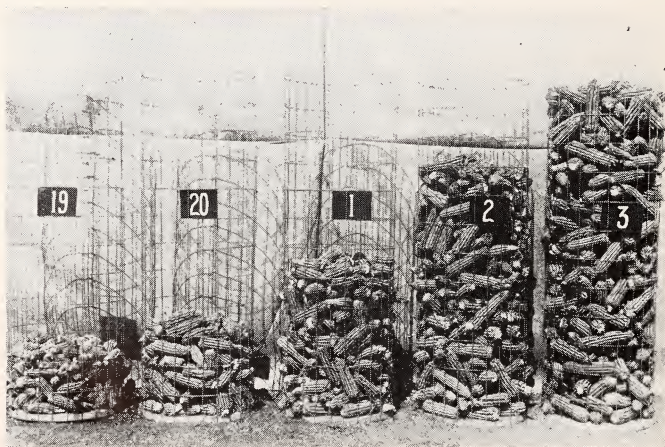


FIG. 10. THESE BASKETS CONTAIN CORN TAKEN FROM PLOTS RECEIVING 0, 20, 40, 80, AND 120 POUNDS OF NITROGEN IN AN EXPERIMENT CONDUCTED ON J. M. MCGOUGAN'S FARM IN HOKE COUNTY. THE YIELDS WERE 19, 27, 45, 82, AND 107 BUSHELS PER ACRE, RESPECTIVELY. ALL PLOTS RECEIVED ADEQUATE PHOSPHORIC ACID AND POTASH.

PERCENT MOISTURE IN SOIL AND YIELD OF MULCHED AND UNMULCHED PLOTS

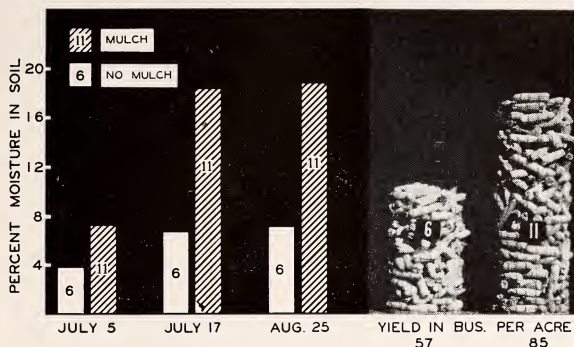


FIG. 11. SOIL MOISTURE CONTENT OF THE 0-2 INCH LAYER AT DATES DURING GROWING SEASON AND CORN YIELDS OF MULCHED AND UNMULCHED PLOTS. BOTH WERE ADEQUATELY FERTILIZED WITH 120 POUNDS OF NITROGEN, 80 POUNDS OF PHOSPHORIC ACID AND 80 POUNDS OF POTASH PER ACRE. THE MULCH (3 TONS PER ACRE OF WHEAT STRAW) WAS APPLIED JUNE 16 JUST AFTER THE CORN WAS "LAID BY."

107 bushels where 120 pounds of nitrogen were used (Fig. 10). The intermediate yields from plots receiving 20, 40 and 80 pounds were 27, 45, and 82 bushels per acre, respectively.

In this experiment, N. C. hybrid 1032 was used and a stand of about 9,000 plants per acre was provided. (Plants 16-17 inches apart in 3.5 foot row.) Weeds were controlled by early shallow cultivation and the corn was "laid by" when it was two feet high.

Good Yield Even Under Dry Conditions

Even under relatively droughty conditions, good yields were produced when adequate stands of adapted hybrids were well fertilized.

This was illustrated on a sandy soil where low rainfall from late May to mid-July resulted in severe leaf roll-

ing and wilting of the corn plants. Plants receiving little or no nitrogen "fired" badly, but those in the high nitrogen plots remained green, although the leaves rolled and wilted.

The per acre yields were increased from 21 bushels with no nitrogen to 61 bushels with 120 pounds of nitrogen. Similar yield increases were obtained from heavy fertilization at three other locations which experienced droughts.

Adequate Stand Necessary for High Yields

Wide plant and row spacings which provide only 3,000-4,000 plants per acre limit corn yield potentialities to 40-50 bushels per acre regardless of season or fertilization. And attempts to increase yields by increasing stand have sometimes failed because fertili-

zation was not increased correspondingly.

To study this problem, an experiment was conducted in 1944, involving the use of three varieties with three spacings at three rates of fertilization. At high nitrogen level where 120 pounds of nitrogen was applied, the per acre yields of N. C. hybrid 1028 were increased from 84 with 28-inch plant spacing in a 3.5-foot row to 100 bushels with the plants 18 inches apart in the row. With Latham's Double the yields were 84 and 95 bushels, respectively, for the 28- and 14-inch spacing in the row.

At the low nitrogen level where only 30 pounds per acre were used, yields of Latham's Double were decreased from 38 bushels at the 28-inch spacing to 31 bushels with the 14-inch plant spacing. This demonstrates the necessity of close spacing for maximum yields where fertilization is adequate. At the same time, it shows that yields may be decreased by close spacing where fertilization is inadequate.

Moisture Conserved and Yields Increased by Mulching

Under droughty conditions on a Lloyd clay loam soil the yields obtained from plots receiving adequate phosphorus and potash and 0, 20, 40, 80, and 120 pounds of nitrogen per acre were 18, 30, 45, 50, and 55 bushels per acre, respectively. Although yields were substantially and profitably increased by the heavy fertilization, it was obvious that the nitrogen response was limited by a lack of moisture. However, on the plots where 3 tons of straw mulch was applied in addition to the high rate of fertilization, the yield was 85 bushels per acre (Fig. 11).

The soil moisture percentages shown in Figure 2 indicate a much larger supply of available moisture in the

soils of the mulched plots than in the unmulched plots.

The soil temperature readings at $\frac{1}{2}$ to 1 inch depth in the mulched and unmulched plots were 82 and 118° F., respectively. Soil temperature measurements were taken in mid-afternoon during bright sunshine when the air temperature was about 95° F.

This location experienced two droughty periods. During the first one (late June and early July) the corn leaves rolled badly in the unmulched plots and only slightly in the mulched plots. The second and more critical drought occurred at roasting ear time (late August) and the plants in the unmulched plots wilted and dried up considerably, while the corn in the mulched plots remained green and matured normally.

The yield of the mulched plot gives an indication of the yields which might have been obtained under average seasonal conditions. At other locations where rainfall distribution was good, no significant differences were obtained from the use of mulch.

Cost and Profits with High Rates of Fertilization

In 1944 eleven corn fertility experiments were conducted under weather conditions ranging from good to very dry. The largest increase due to fertilization was from 19 to 107 bushels per acre (Fig. 10) and the lowest from 21 to 53 bushels per acre which was obtained under very droughty conditions.

Average yields of all eleven experiments were 21, 32, 48, 59, 63, and 72 bushels per acre from plots receiving 0, 20, 40, 60, 80 and 120 pounds of nitrogen per acre, respectively. Yields from mulched plots or cover crop plots were not considered in these averages, so responses are due to direct fertilization.

Adequate stands of adapted hybrids were used with adequate phosphoric acid and potash in all these experiments. Figure 12 shows that under the conditions of these experiments the greatest potentialities for profits in corn production came with adequate fertilization.

Treatment of Corn Seed Gave Low Increases in Germination

In the first of two series of corn seed treatment tests in 1944, 13 lots of seed were assembled from as many growers of certified corn seed representing six different varieties grown in the Piedmont and Coastal Plain areas of the state. Seed treated with Semesan Jr. and untreated seed of each of the 13 lots were planted at McCullers May 8, May 20 and June 23.

In the first planting, the seed came up promptly, soil moisture being favorable for rapid germination. The average number of seedlings from the untreated and from the treated seed of the 13 lots was exactly the same—93.9 per cent. In the second and third plantings the seed encountered dry weather and germinated slowly. In the second planting 71.5 per cent of the untreated seed came up. The treated seed gave an increase of only 2.6 plants for each 100 seeds planted. In the third planting 60.7 per cent of the untreated seed came up while the treated seed gave 3.7 more plants than the untreated for each 100 seeds planted. These small differences are of no practical significance.

In the second series of the test different portions of each of five lots of

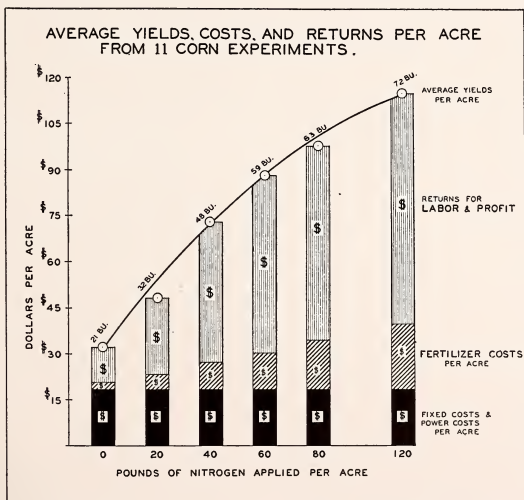


FIG. 12. RETURNS IN DOLLARS FROM AVERAGE YIELDS OF 11 CORN EXPERIMENTS. VALUES ARE FIGURED AT 1944 PRICES (CORN \$1.50 PER BU., LABOR 30 CENTS AN HOUR; MULE POWER 22 CENTS AN HOUR.) FERTILIZER COSTS INCLUDE COST OF NITROGEN APPLIED PLUS THE COST OF $1\frac{1}{2}$ TIMES THE PHOSPHORIC ACID AND $1\frac{1}{4}$ TIMES THE POTASH REMOVED BY THE GIVEN CORN YIELDS.

corn seed were treated with four chemicals, one portion of each lot being planted as an untreated control. Plantings were made at Rocky Mount, Statesville and Plymouth. Three times as many seed were planted as the number of plants desired for a complete stand. All chemicals gave small increases except at one location. None of the increases was large enough to result in increased yields after the rows were thinned to leave as nearly as possible one plant every 18 inches.

1944 Official Corn Tests

The results of the 1944 Official Corn Performance Tests show that certain

corn hybrids are superior to open-pollinated varieties, whereas others are no better or distinctly inferior. But the use of good seed of the best hybrids available should make the growing of a corn hybrid worthy of careful consideration.

The most desirable yellow hybrids include: N. C. 1028, N. C. 1032, N. C. T1, N. C. T11, N. C. T12, N. C. T23, U. S. 282, Funk G703, Funk G713, Funk G714, Funk G717 and Wood S210. The desirable white hybrids include: N. C. T8, N. C. T20, N. C. 1111, N. C. 1114, Tenn. 10, Tenn. 15, Wood V120, and Wood S310.

COTTON

Planting Rates for Treated Cotton Seed

Treating cotton seed decreases the proportion of missing hills and reduces the number of seeds per hill required to give satisfactory stands. In a planting where the germinating seeds were subject to low soil temperatures, untreated and Ceresan treated seed gave, respectively, 50 per cent and 35 per cent of missing hills when the seeding rate was two seeds per hill. Increasing the number of seeds to five per hill decreased the missing hills to 21.4 per cent where untreated seeds were planted and to 8.7 per cent where Ceresan treated seeds were used. Planting eight seeds per hill further decreased the missing hills to 13.8 per cent where untreated seeds were used and to 4.8 per cent where Ceresan treated seeds were planted. Five treated seeds gave a satisfactory number (3.4) of plants per surviving hill. The hills were planted 12 inches apart, and where 5 or 8 treated seeds were planted the missing hills were well distributed along the rows. Picking data showed no significant differ-

ence in yield between the 5- and 8-seed rows. The 2-seed rows, where the proportion of missing hills was higher, yielded significantly less than the 5-seed rows.

In another planting, made when soil temperatures were high, five treated seeds per hill gave 99.2 per cent of surviving hills. Planting eight seeds per hill did not increase the percentage of surviving hills but did increase the average number of plants per hill from 4.0 where five seeds were planted to 6.3 plants where eight seeds were planted.

Some of the rows planted to 5- and 8-seed hills were thinned to two plants per hill. This thinning did not increase the yield of seed cotton above that of comparable unthinned rows. At the planting rates used the labor incident to thinning was wasted.

Leguminous Cover Crops Furnish Enough Nitrogen for Cotton

Leguminous cover crops such as that shown in Figure 13 produced adequate nitrogen for cotton in a cotton-corn rotation in 1944.



FIG. 13. AUSTRIAN PEAS AS A WINTER COVER PRODUCED SUFFICIENT NITROGEN FOR COTTON.

Thirty-six pounds of nitrogen on cotton with no cover or following Italian rye grass produced 1,961 pounds of seed cotton per acre under both conditions. With Austrian winter peas or with hairy vetch as winter cover, yields of 1,990 and 1,981 pounds of seed cotton were obtained with no nitrogen applied to the cotton. The peas and vetch produced 2,550 and 2,530 pounds of tops per acre (air dry basis) before they were turned under in the spring. Early seeding and a good stand of cover crops are necessary to obtain these results.

Promising New Preparations for Cotton Seed Treatment

Two comparatively new dust preparations, DuBay 1452-F and Dow 9 showed up well on cotton seed in field trials in 1944. DuBay 1452-F gave as large increases in seedling emergence as Ceresan, and has the advantage of being less offensive than Ceresan to

persons engaged in the operation of treating seed. Dow 9, when used at proper dosage, gave approximately the same protection to cotton seed as Ceresan. This material is thought to be less likely than Ceresan to have harmful effects on persons who handle it in the seed treatment operation.

Structure of the Cotton Fiber

A mature cotton fiber is enclosed by a sheath or skin which influences many of its physical properties. A detailed study of this sheath has shown that it is more complex than previously recognized.

From a standpoint of development, the sheath is composed of the primary membrane or layer and the outermost layer of the secondary wall. The primary wall is the membrane which the fiber possesses during the first 14-17 days after flowering, that is, during the period that cell elongation is taking place. The outermost layer of the secondary wall is the first zone deposited after the fiber has reached its mature dimensions. The two layers act as a unit because of the presence of waxes and pectic substances that are absent in the rest of the fiber wall. On the other hand, the cellulose in the two outer layers are oriented differently and thus the sheath behaves as a plied structure.

The work was continued on the fine structure of cotton cellulose with particular emphasis on the changes taking place during the time that fibers undergo their first or initial drying.

It has been found that crystallization of the cellulose takes place during the initial drying and many of the fiber properties are determined then. The absence of a crystalline structure in the undried cotton can only be explained by the presence of water between the long-chain cellulose molecules. Other experiments have indicated that the amount of water sep-

arating the cellulose chains is definitely limited. Although the physical properties of the fiber may be altered widely under experimental conditions, these conditions are out of the range normally found in the field.

Apply All Potash to Cotton in Cotton-Peanut Rotation

Rotation-fertilizer experiments conducted for the past six years at each of five locations show that the greatest benefit from applied potash comes from adding all of it to cotton (Fig. 14).

Twenty-five pounds potash (or K_2O) per acre (50 pounds muriate of potash) on peanuts in addition to 24

pounds on cotton gave higher yields than just 24 pounds potash on cotton on all soils except the Lenoir soil. Fifty pounds of potash on peanuts in addition to 24 pounds on cotton, a total of 74 pounds in the rotation, gave still higher yields on three of the soils. As can be seen, on every soil 48 pounds of potash directly on cotton gave the highest yield and in addition the yields of peanuts were not increased by direct application of potash on them.

Fertilization of the rotation rather than fertilization of the individual crop should be practised and amounts of nutrients to compensate for crop removal and leaching must be added.

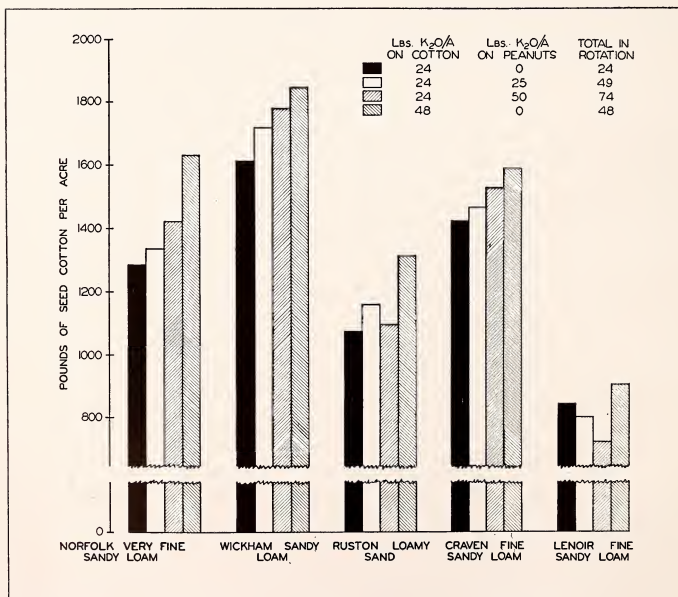


FIG. 14. EFFECT OF DISTRIBUTION OF POTASH (K_2O) IN A COTTON-PEANUT ROTATION ON YIELDS OF SEED COTTON.

In this rotation cotton is more responsive to potash and greatest returns were obtained from applying all to the cotton.

High Fiber Strength

Twelve different cottons with exceptionally high fiber strength were collected from different places through the cotton belt and grown together in 1944. The morphological characters of the plant, boll and lint associated with this exceptional strength varied a great deal and no visible characters were found that can be connected with strength, that the strong fibered types do not fluff in the open boll to as great an extent as the lint from commercial varieties. However, biological decay reduces fluffing in all cottons and therefore, this characteristic may be used only in the absence of deterioration.

At the present time, cottons possessing exceptional fiber strength have been found only in occasional inbred lines and in certain strains (as in Acala W29-1) from the irrigated southwestern regions, which are not adapted to North Carolina conditions. In the cottons grown in this area, the factors responsible for exceptional fiber strength are either absent or present in such a small percentage of the population that they have not been isolated.

Inheritance Vs. Environment in Fiber Quality

Strength, fineness and other properties of cotton fibers are inherited, but they are also influenced by environmental conditions. However, the environmental effect is usually in the same direction on all varieties grown under the same conditions.

Therefore, a variety which has superior quality under favorable conditions would be expected to produce

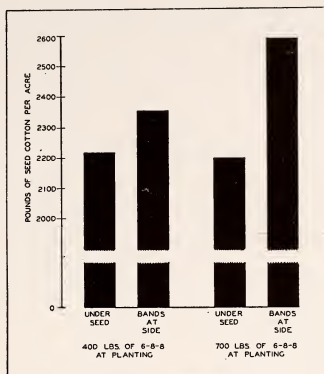


FIG. 15. EFFECT OF PLACEMENT ON RETURNS FROM HIGHER AMOUNTS OF FERTILIZER ON COTTON.

relatively better fiber than other varieties under less favorable conditions. Fourteen varieties and strains, having a considerable range in fiber properties, were grown at both Rocky Mount and Statesville in 1944. The fiber from Rocky Mount was consistently stronger and more uniform in length, but coarser than the fiber from Statesville.

Fiber quality also varies from year to year at the same location. Records on ten strains grown for three years at Statesville show that the strength, fineness and uniformity varied each year. The 1942 crop had especially weak and coarse fiber, while the 1943 and 1944 crops were considerably finer and stronger. This would explain why manufacturers find that cotton from certain areas produces strong yarns some years, but does not come up to requirements other years and cannot be used.

Side Placement Necessary for Higher Amounts of Fertilizer

Results obtained in 1944 on Norfolk

fine sandy loam show that the value of side placement of fertilizer for cotton increases as the rate of fertilizer application increases (Fig. 15). Otherwise, the extra fertilizer used is wasted.

With an application of 400 pounds of 6-8-8 per acre, the advantage for side-placement over under-seed placement was 134 pounds of seed cotton. With 700 pounds of 6-8-8 the difference was widened to 393 pounds of seed cotton. With under-seed placement the yield was not affected by the additional fertilizer and the 300 pounds of fertilizer was thus essentially wasted.

1944 Official Cotton Variety Tests

The results of four 1944 Official Cotton Variety Tests in Cleveland, Hoke, Scotland and Halifax counties indicate that the Coker 100, Coker 100 Wilt and Coker 200 cotton varieties are outstanding in production under North Carolina conditions, and that superior new strains are being developed.

New strains of Coker 100 Wilt Resistant cotton were found to give satisfactory performance when grown on wilt infected soil. In a test where 20 per cent of the plants of Coker 100 were infected by wilt, less than 1 per cent of the plants of commercially available wilt-resistant strains showed evidence of wilt.

Influence of Fertilizers Upon Fiber Quality

Preliminary results from tests in which sensitive fiber measurements were made to evaluate the influence of potash, nitrogen and lime upon single fiber strength, fiber diameter and staple length show that the supply of plant nutrients does affect cotton fiber quality. Other characteristics such as fiber bundle strength, fiber

bundle fineness, lint percentage, boll size, and the percentage of oil in the seed were also determined. For the work, cotton, from experiments in which a response in yield to potash, nitrogen or lime had been obtained was used.

The effects of increasing the potash from 36 pounds per acre to 72 pounds per acre were determined in an experiment on Norfolk very fine sandy loam. Increasing the rate of potash decreased the percentage of thin-walled fibers from 14 to 9 per cent. On Ruston loamy sand increasing the potash from 24 pounds per acre to 48 pounds per acre decreased the percentage of thin-walled fibers from 32 to 23 per cent. Potash was still limiting at the 48-pound level, however, as visible potash deficiency symptoms were evident on the leaves. On both these soils this decrease in thin-walled fibers was associated with an increase in single fiber strength and a decrease in the very weak fibers. There was no effect on staple length or fiber diameter. Increasing the rate of potash increased the weight of the boll, the lint percentage, and the percentage of oil in the seed in each case.

In a similar experiment on Craven fine sandy loam, the effect of potash in increasing yields was not as marked and only the lint percentage was affected.

On Lenoir fine sandy loam previous applications of dolomitic limestone on peanuts increased the weight of bolls. There were no other effects.

Increasing the nitrogen in a complete fertilizer from 0 to 18 to 36 pounds per acre increased the size of bolls. The cotton receiving 36 pounds of nitrogen had a somewhat higher percentage of thin-walled fibers and a lower lint percentage, however. There was no effect on the staple length or fiber diameter.

Limestone Increases Yields of Cotton

Applications of limestone in a field experiment on Norfolk loamy sand (pH 5.1) increased yields of seed cotton to a marked degree, even though soluble magnesium was added in the fertilizer to all plots. The yield with no lime was 1,188 pounds of seed cotton, while the yields from 1,000, 2,000 (80 per cent calcium saturation), and 4,000 pounds of limestone were 1,479 pounds, 1,607 pounds and 1,593 pounds of seed cotton, respectively. The number of plants at harvest was one-fourth greater on the limed plots and the additional limestone did not increase the need for potash.

A similar experiment was conducted in the greenhouse on Ruston loamy sand with the cotton plants harvested at eight weeks. Increasing the degree of calcium saturation gave progressively higher yields of tops on up to complete calcium saturation and the potash requirement was not affected under the conditions of this experiment.

These experiments indicate the importance of the calcium nutrition of the cotton plant. Thus, application of limestone in accordance with soil requirements should prove beneficial to cotton.

PASTURES AND FORAGE

Sericea Lespedeza Inferior to Kobe For Grazing

Cattle gains made from sericea lespedeza were little more than one half as much as those from a comparable area of Kobe lespedeza during 1944.

The cattle were allowed to graze the sericea from June 27 until September 19, although very little gains were made before August 22. The sericea was approximately 18 inches high before the cattle were put on the paddock, and there were few evidences of any being eaten before it was mowed on August 1. After then, the cattle kept the crop grazed to a height of six to ten inches. Practically all the gains were made after the crop was mowed, which makes it obvious that sericea must be grazed fairly closely if cattle are to eat it.

The gains from Kobe lespedeza were fairly uniform from the time the cattle began grazing on July 11 until they were removed from the paddock October 3.

Adequate Potash Required for Lespedeza in Permanent Pasture

The necessity of providing adequate potash for lespedeza in a permanent pasture sod was clearly demonstrated during 1944 at the Lower Coastal Plain Experiment Station.

Dallis grass-lespedeza seedings that were made in 1940 steadily decreased in yield through 1943 as follows:

1941	3,364 pounds dry matter
1942	1,694 pounds dry matter
1943	1,486 pounds dry matter

This seeding had been fertilized at the time of establishment in 1940 with limestone, phosphate, and potash but no additional fertilizer had been added. Since potash deficiency symptoms were observed during 1943, a liberal application of muriate of potash was made in the fall of 1944 when the original treatments were re-applied on all seedings. During the 1944 season, 4,124 pounds of dry matter

were harvested from the same Dallis grass-lespedeza seedings that had produced only 1,486 pounds in 1943.

Under similar conditions low hop clover and Kent white clover did not respond in the same manner to additional applications of potash. Their yields in pounds dry matter per acre were as follows:

	1943	1944
Dallis grass- low hop clover	3,008	3,169
Dallis grass- Kent white clover	3,175	3,050

The differences in the responses of these three legumes to potash may not be as large as these values would indicate, however, since they make their maximum growth at different seasons of the year. Also the rainfall was more favorable during July and August, when the lespedeza was making its greatest growth.

The 1944 results do show, however, that satisfactory yields of Dallis grass-lespedeza can be produced if the sod is adequately fertilized.

Alfalfa Good Hay Crop

The superiority of alfalfa over other hay crops was demonstrated under favorable as well as adverse growing conditions during 1944. Alfalfa produced three and one-half tons of hay per acre in an experiment in the Upper Coastal Plains, whereas a little less than one ton of lespedeza was harvested. Even though there were occasional short droughts the weather was approximately normal. At the College dairy farm, however, the supply of moisture was so critical in the early summer that the lespedeza crop was a failure. In spite of this drought 4,700 pounds of alfalfa hay was harvested at the same location. The advantages of a deep rooted perennial were thus more pronounced during a

year that was characterized by a severe drought.

Liberal Fertilization for Alfalfa

The need for adequate phosphate fertilization for alfalfa is shown in the results from the first year of a rate of phosphate experiment. The soil used was above average in fertility and already had a fair amount of phosphate present. The rates used were 0, 40, 80, 120, and 160 pounds of phosphoric acid per acre. While stands were satisfactory at all rates good increases in yield were obtained from phosphate the first season. These ranged from about 20 per cent on the 40-pound rate to 36 per cent for 160 pounds of phosphoric acid. As the soil supply of phosphate is exhausted by succeeding crops the differences in favor of the higher rates would be expected to become larger.

Seeding Rates for Alfalfa

A satisfactory stand of alfalfa may be secured with less than the recommended 25 pounds per acre of seed, if the proper precautions are taken. Evidence of this may be seen in the results from two rates of seeding trials established in the fall of 1942.

One of these was located on a field relatively free of weeds, fairly fertile and on which a good seedbed could be prepared. Here, in 1944, there was no difference between the yields from the 10-, 20-, or 30-pound seedings. The stands were uniform, free of weeds and produced over three and one half tons of high quality hay.

The other location was a field that was in a poor state of cultivation and was rather weedy. In this experiment, in 1944, the yield from the 20-pound seeding was a half ton higher and the 30-pound seeding three-fourths ton higher than that from the 10-pound seeding. The stand on the 10-pound

seeding was spotty and contained a high proportion of weeds. The 30-pound seeding had some weeds and the stand was far from perfect, though still fair. The simple fact was that this field was not ready for alfalfa. It was possible to establish a fair stand on it but a much better and cheaper job could have been done after the field had been "made ready." This could have been done through clean cultivation and the use of close growing legume crops such as lespedeza.

It seems from these, and other experiments, that 20 pounds of alfalfa seed per acre would allow a good margin of safety when proper care is taken in preparing for and seeding this crop, and where conditions are known to be favorable, even fewer seed than this could be used. If more seed are necessary the chances are that seed are being used to overcome some handicap that might better be dealt with directly. Extra seed are an expensive and often unsatisfactory substitute for any of the following precautions:

(1) Clean up the field, don't seed on weedy land.

(2) Disc down a legume crop such as lespedeza to prevent washing and baking of the surface soil.

(3) Prepare a shallow, firm seed-bed.

(4) Fertilize and lime adequately.

(5) Inoculate with care.

(6) Distribute and cover seed uniformly.

Alfalfa-Grass Mixture Suggested

A mixture of alfalfa and a perennial grass should (1) reduce the chances of stand failure, (2) decrease hazards from heaving, (3) increase the longevity of the stand, (4) be more effective in erosion control, (5) make curing easier, and (6) reduce the seeding costs. Also, from this mixture greater yields are often reported than from

straight alfalfa seedings. Seeding orchard grass with alfalfa has not materially affected the total yield of hay in the experiments conducted by this Station, but it has reduced the seeding cost inasmuch as the grass seed are much cheaper than alfalfa seed. Such a seeding practice would appear to have particular merit where the alfalfa crop is to be grazed.

New Forage Plants for North Carolina

Nursery plantings for the past two or more seasons in the state have been used to determine which of several out-of-state varieties of forage grasses and legumes are most suitable for planting in North Carolina, and in 1944 a number of the more promising varieties were established in yield trials for more accurate evaluation.

Several hay-type Bermuda grass strains, developed by the U.S.D.A. in cooperation with the Georgia Coastal Plain Experiment Station, have been observed for three seasons. One of the most promising, Coastal Bermuda grass, is more vigorous and productive than local Bermuda strains and is far superior to the Bermuda grass obtained from commercial seed. This strain is increased by planting stolons as it produces little seed. This lack of seed helps to prevent the grass from spreading into areas where it is not



FIG. 16. UNADAPTED COMMERCIAL BROME GRASS ON LEFT. VIGOROUS STRAIN FROM KANSAS ON RIGHT.

desired. Coastal and two other hay-types are now included in a yield test.

Although smooth brome grass is not widely grown in North Carolina, it has attracted attention because of its great popularity in other sections, particularly as a companion of alfalfa. The adaptation of brome grass to North Carolina conditions is now under test in several experiments. The numerous strains of brome grass may be grouped according to the regions from which they arose into northern and southern types. In two seasons at Raleigh, the Kansas and Nebraska strains and others in the southern type have made much more growth than the northern strains (Fig. 16). Unfortunately, most commercial seed of brome grass appears to be of the northern type and not well adapted to North Carolina.

There are two distinct varieties of meadow fescue, a grass of limited importance in North Carolina. Most commercial meadow fescue and the introduced European strains are pasture types similar to rye grass in appearance. They are perennial but have made rather unsatisfactory growth at Raleigh in several seasons. Suiter and Alta (Fig. 17) and several unnamed strains of tall meadow fescue, the second type, have also been observed. These are well adapted, hay-type grasses which make a heavy growth in the spring and also grow well in the fall. The leaves and stems are tough, so this grass cannot be generally recommended until palatability trials have demonstrated that it is acceptable to livestock.

Preliminary studies of a number of winter legumes, including vetches, bur clovers, winter peas, and true clovers were begun in 1944. One of the more promising of these is a naturally re-seeding strain of crimson clover which is being developed in cooperation with the U.S.D.A.

In the fall of 1941, several crimson clover strains which had previously shown a tendency to produce hard seeds were planted at the Piedmont Experiment Station. These clovers were permitted to volunteer without reseedling in the fall of 1942 and again in 1943. Although the seed were not all hard in any of the strains, germination was sufficiently delayed in three of them to result in satisfactory stands. Seed of these strains have been blended and are being increased as a new variety, Dixie crimson clover, with a limited supply of seed to be available in the fall of 1945. If the volunteering habit proves to be dependable, many of the hazards associated with growing crimson clover will be eliminated.



FIG. 17. ALTA, A VARIETY OF TALL MEADOW FESCUE IN LEFT FOREGROUND, LOW YIELDING COMMERCIAL MEADOW FESCUE ON THE RIGHT.

Kudzu Demonstrates Its Value

The eroded areas planted to kudzu in 1940, as part of the Statesville pasture project, are now supplying bountiful grazing during the critical drought periods of the summer. The availability of this kudzu as a supplementary pasture has made it possible

to keep the dairy herd off the permanent pasture during critical periods, thereby preventing over grazing the permanent sod.

One portion of the kudzu, containing some of the original brush and briars, was disked heavily and treated with 500 pounds per acre of 0-14-7 after first removing the competing growth. This treatment proved highly beneficial as the kudzu came out with a vigorous growth. Clearing out the competing vegetation, together with the disking, permitted the new runners to peg down frequently and form new crowns. Similar treatment is recommended in the establishment of a thick kudzu stand.

Orchard Grass and Bluegrass Better Than Redtop

Redtop has been recommended for permanent pastures in North Carolina

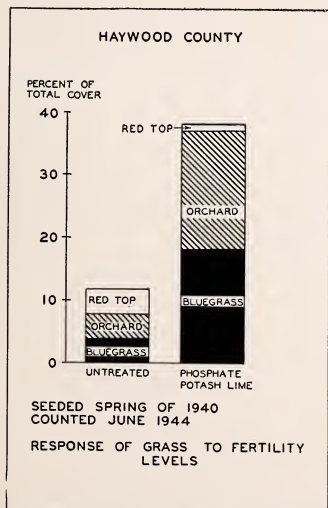


FIG. 18. PERCENTAGE OF EACH GRASS IN SOD, JUNE 1944.

because of its ability to survive under adverse soil conditions. But where conditions are suitable for their growth, both orchard grass and Kentucky bluegrass are superior to it for pasture production. An excellent example of this is shown in results from an experiment in Haywood County. (Fig. 18.)

In this experiment, five pounds of each of these grasses were seeded together with a mixture of white clover and lespedeza in 1940. Counts made on this same experiment at other times and counts made on a similar experiment in Buncombe County show the same condition as pictured here. Thus, redtop was able to survive in competition with the more desirable grasses on the unfertilized soil where none of them produced much growth. When placed on a fertilized soil where a satisfactory growth of orchard and bluegrass could be produced, it could not survive the competition. This shows the lack of response to treatment that can be expected from redtop and points to the desirability of seeding such grasses as orchard and bluegrass where conditions are made favorable for their growth.

Good Fertilizer and Management Required to Maintain Dallis Grass Pastures

Dallis grass should be able to compete successfully with carpet grass on poorly drained soils if it is fertilized and is not overgrazed.

This was found when an experiment was set up to discover why most of the carpet grass pastures in North Carolina have resulted from seeding a mixture of Dallis grass and carpet grass.

The experiments began in the greenhouse when the two grasses were grown under three moisture levels (Figs. 19 and 20). The response to the high moisture level was slightly



FIG. 19. DALLIS GRASS GROWN UNDER THREE MOISTURE LEVELS:

1=HIGH
2=MEDIUM
3=LOW

greater for Dallis grass when measured in terms of top growth and the differences in the root growth were even more striking: Dallis grass was increased 271 per cent, whereas carpet grass was increased only 40 per cent. Severe defoliation treatments have also been more harmful to the growth of Dallis grass than to carpet grass. Previous work at this Station likewise has shown Dallis grass to be more responsive to higher fertility levels than carpet grass. Any environment that encouraged the presence of legumes has increased the ratio of Dallis grass to carpet grass.

To test these observations on a more comprehensive basis, the plots were refertilized in the fall of 1943 and were cut to a height of approximately two inches in 1944 rather than to one inch as in previous years. The relative amounts of the two grasses were as follows:

	JUNE		SEPTEMBER	
	Dallis	Carpet	Dallis	Carpet
1941	65	35	39	61
1942	48	52	22	78
1943	28	72	26	74
1944	51	49	45	55

These results would indicate that by proper management and adequate fertilization, the percentage of Dallis grass can be increased in the permanent pastures of Eastern North Carolina.

Good Management Needed for Permanent Pastures

Permanent pastures are an economical source of feed for livestock as they can be established on cheap land at a low cost.

This was found to be the case on an 11-acre tract of abandoned hill land in Buncombe County which, in 1940, was a gullied area containing a few



FIG. 20. CARPET GRASS GROWN UNDER THREE MOISTURE LEVELS:
1=HIGH
2=MEDIUM
3=LOW

pinus, some broomsedge, and a lot of saw briars. In the season of 1944 the 11 acres carried 11 animals for 106 days, or a cow per acre for three and a half months. The year before, 1943, it carried six cows for 76 days. Clippings from the fertilized area showed an increase in herbage from desirable plants of over 400 per cent above the unfertilized area. This transformation of a worthless piece of land into a productive pasture was accomplished with a relatively small cash outlay.

Seedbed preparation consisted of a light disking. One ton of limestone, 400 pounds of superphosphate, 1 bushel of rye and 25 pounds of lespedeza per acre were used the first

year. Then in the fall of 1942, after two seasons' growth of lespedeza, the area was disced lightly and 5 pounds of bluegrass and 8 pounds of orchard grass per acre were seeded. The total cost of lime, fertilizer, and seed was \$13.37 per acre.

This sod could not have been developed without good management, which consisted of two things: (1) controlled grazing, almost no grazing the first season and then a gradual increase in grazing as the sod developed, with the cows always a little behind the growth, not ahead of it; and (2) control of weeds, the pasture was clipped with a mowing machine twice a year.

PEANUTS AND SOYBEANS

Pegs, "Pops," and Peanuts

The unique habit of underground pod development which makes it nec-

essary to "dig" the peanut crop has complicated the relationship between flower production and yield of mature peanuts. A study of what happens to

the many flowers which fail to produce pods has shown that "pop" formation is only one phase of fruit failure in peanuts.

Single Jumbo Runner plants, well fertilized and given plenty of space in the row, produce 400-600 flowers in the growing season. Less than 15 per cent of these flowers produce mature pods by the end of the season. This is true of plants in which the pods are mostly empty "pops," because calcium is lacking, and also of plants which produce high quality peanuts. More than half of the flowers in each case, however, develop small immature pods, which rob the plants of food materials without contributing to yield.

Some of the flowers produced on a given day, of course, do not develop at all. This occurs in many crop plants, cotton is a familiar example. In the peanut, however, the flowers which develop do so at differing rates. Three weeks after a particular group of flowers open all degrees of peg and pod development may be found. The ovaries of some flowers have remained dormant in the leaf axil ready to grow when favorable conditions occur. Others have produced pegs which have not reached the ground. Some have pegs just penetrating the soil, while a few are well underground with pods already an inch long. To this variation in the development of flowers opening on one particular day, is added the fact that the plants start flowering about five weeks after planting and continue to flower for a period of two months. It is not surprising, therefore, that the time of maturity of the peanut crop is not clear cut and that partially developed pods are encountered at harvest.

Although single-segmented, single-seeded pods occur frequently at harvest, all the flowers are inherently two or three seeded in the varieties

studied. The one seeded pods frequently harvested are the result of the failure of one or two of the ovules originally present to produce seeds. Examination of the flowers after pollination has shown that the egg cells are fertilized in about 95 per cent of the ovules. Failure of ovules to become seeds in the one-segmented pods and pop formation, which occurs later, are not the result of sterility at the time of flowering.

In the most rapidly developing pegs, the pods are approaching mature size at the end of four and a half to five weeks of growth, although the seeds are still small and immature. The differences between pops and normal pods can be seen. When growing normally, the young seeds are surrounded by a white food storage tissue, closely pressed against them on all sides. In pops at four and a half weeks, the seeds have nearly stopped growing and there is a cavity between them and the storage tissue. There are all degrees of the pop condition from pods in which the seeds stop growing when only one-eighth an inch long to pods in which they approach normal size but are shriveled and discolored.

Between flowering and maturity there are several ways in which peanut pods may fail to develop properly. Flowers fail to produce pegs; retarded growth prevents the pegs from bearing mature pods; the pods themselves, though reaching mature size, fail to bear the full number of seeds; or the seeds fail to mature even when the pods are normal.

Strains Released by Station

The testing program of the past several years culminated in 1944 in the release of several tested strains of peanuts for the two different peanut growing areas in the state.

The Upper Coastal Plain Station located near Rocky Mount produced

75 bags of N. C. strain #4, 90 bags of N. C. #31, 4½ bags of Martin County Runner as foundation seed stocks for distribution in the old peanut belt and 16 bags Spanish 2B for distribution in the southern part of the state.

Seed stocks of Ga. 207-2, N. C. 1296, N. C. Runner, and N. C. Bunch were also built up preparatory to release should their continued performance warrant it. County agents and individual farmers are cooperating in increasing these foundation stocks for sale as certified peanut seed for the 1946 season.

The shelling percentage of N. C. #31 has averaged 61.5, N. C. #4 63.3, Martin County Runner 66.7, and Spanish 2B 70.9. The N. C. #31 and N. C. #4 are large Virginia Bunch nuts; Martin County Runner, a medium runner; and Spanish 2B, a large Spanish. Size relationship of shelled peanuts can be most readily seen by counting the number of shelled nuts in a given unit of weight. Compared with a commonly grown variety averaging 44 nuts per ounce, N. C. #31 averaged only 38 nuts per ounce; N. C. #4, 40 nuts per ounce; Martin County Run-

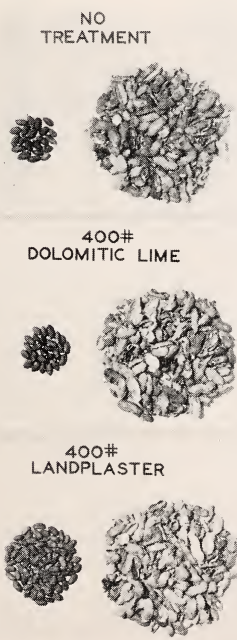


FIG. 21. ON A SOIL OF LOW CALCIUM LEVEL, APPLICATIONS OF GYPSUM ON THE FOLIAGE ARE BETTER THAN DOLOMITIC LIMESTONE IN THE ROW.

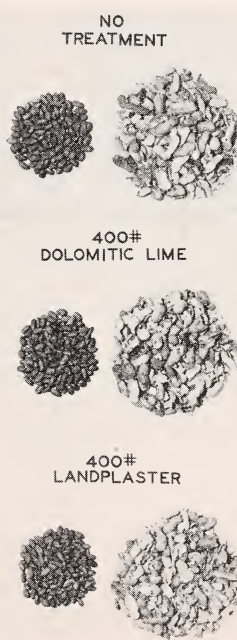


FIG. 22. ON A SOIL HIGH IN CALCIUM, NEITHER GYPSUM NOR LIMESTONE INCREASED YIELD OR SHELLING PERCENTAGE.

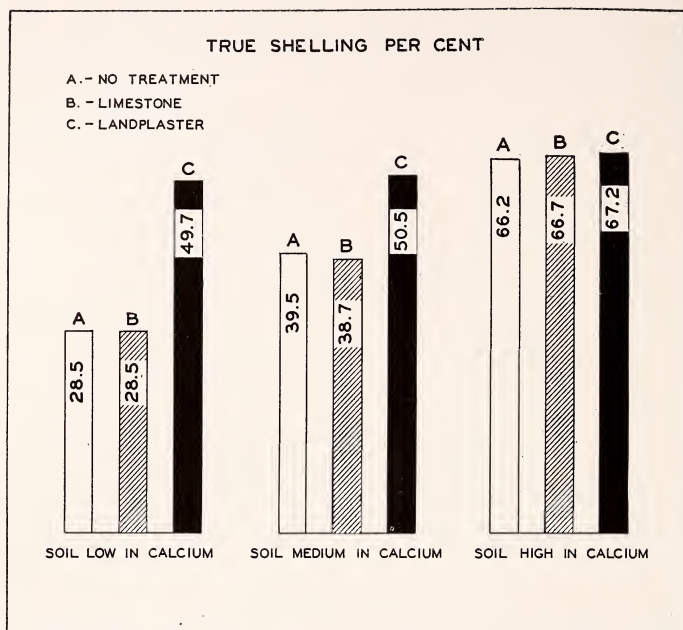


FIG. 23. WHERE THE SOIL IS LOW TO MEDIUM IN CALCIUM, APPLICATIONS OF PLASTER INCREASE THE SHELLING PERCENTAGE

ner, 53 nuts per ounce; and Spanish 2B, 50 nuts per ounce. In six different tests in 1944, N. C. #31 averaged 2,016 pounds per acre; N. C. #4, 2,290 pounds per acre (two tests); Martin County Runner, 2,159 pounds per acre; and Spanish 2B, 2,271 pounds per acre.

Calcium Necessary for Good Quality Peanuts

Experiments have shown that where an application of landplaster increases peanut yields it is due to the beneficial effects of calcium which is applied in the part of the soil in which the peanuts form.

If the soil has a high calcium level, the plaster is not likely to be helpful and good yields of high quality peanuts can be produced without it. On the other hand, if the calcium level is low, peanuts are helped considerably by plaster applied in such a way that it furnishes available calcium to the pegging zone. This is illustrated in Figures 21 and 22.

These figures also show that dolomitic limestone applied in the row did not help nearly as much as did plaster on the foliage. Notice that the pile of empty shells is about the same size for all treatments. This indicates that calcium exerts its beneficial effect by

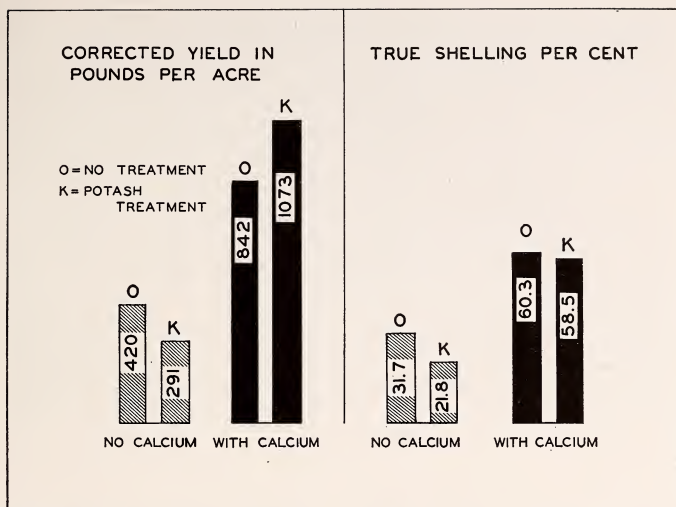


FIG. 24. ON A SOIL VERY LOW IN AVAILABLE POTASH, WHEN CALCIUM NEEDS ARE MET, AN APPLICATION OF POTASH MAY INCREASE THE YIELD OF PEANUTS. YIELDS ARE CORRECTED TO POUNDS PER ACRE SHELLING 60 PER CENT LARGE AND MEDIUM KERNELS.

reducing the number of pops or by causing more shells to fill rather than by increasing the number of peanuts on the plant.

This fact is further illustrated by the graphs in Figure 23. Notice the effect that calcium (plaster) has on shelling percentage. In the case of soils low in calcium, the true shelling percentage was increased considerably by plaster applications. When the calcium level was high, the shelling percentage was already high and calcium was without effect.

Various Sources of Calcium on Peanuts

As calcium is extremely important in peanut production, questions naturally arise as to which sources of calcium are best and when and where

they should be applied to be of the most benefit. Experiments were started in 1944 to help answer these questions.

Soils low in calcium were selected so that calcium response would be obtained. Indications from one year's results are that calcium may be efficiently supplied by plaster or by broadcast application of limestone. Hydrated lime and burnt lime applied on top of the row about a week after planting were beneficial, though not as efficient in these tests as plaster applied on the foliage or broadcast applications of ground limestone made two months ahead of planting.

Nitrogen on Peanuts Not Profitable

In experiments with four varieties of peanuts receiving applications of

nitrogen at three different rates, those peanuts which received no nitrogen at all yielded as much as those receiving nitrogen.

The varieties included Virginia Bunch, North Carolina Runner, Improved Spanish (2B), and ordinary Spanish. Nitrogen was applied at rates of 0, 6, 12, and 24 pounds per acre. Even though the tests were conducted on sandy soils low in organic matter, nitrogen was not profitable in the case of any of the varieties at the rates applied.

Method of Applying Potash to Peanuts

Although a peanut crop usually removes considerable potash from the soil, peanuts seldom show a response to applications of potash made directly to them.

If the soil is moderately well supplied with potash, the best practice seems to be that of applying no potash to peanuts but maintaining the potash level of the soil by applying additional potash to other crops in the rotation.

Exception to this may be found in soils extremely low in available potash. This is illustrated in Figure 24. Response to potash has been noticed only where the soil potash was very low and where the calcium requirements were also supplied.

Various methods of applying potash to peanuts were compared on soils with very low contents of available potash. Where the calcium requirements of the soil were **not** met, potash applied as a topdressing was actually harmful and reduced yields slightly. On the other hand, where the calcium requirements were met, applications of potash in the row, broadcast, or as a topdresser produced about the same results. In all cases response was slight. This bears out the recommendation that insofar as possible,

potash should be applied to other crops in the rotation.

Winter Cover Crops Did Not Increase Peanut Yields in 1944 Experiment

Experiments conducted at Rocky Mount (Edgecombe County) showed that turning under various winter cover crops did not increase the yield of peanuts.

Peanuts were grown in a three-year rotation involving cotton and corn, both of which benefitted greatly from turned under winter cover crops. But with peanuts, the yield was as high following no cover as it was after rye, vetch, crimson clover, or Austrian winter peas. This experiment has only been carried out for two years and it will be necessary to continue it for some years before any definite conclusions can be drawn.

Harvest Peanuts on Time

Considerable difference of opinion still exists among farmers as to the proper time to dig peanuts. Digging dates vary from mid-September to mid-October or even later. In date-of-harvest experiments it has been shown that too early a harvest was more detrimental than a delayed harvest. Peanut yields increased 40 per cent in 1942 and 30 per cent in 1944, or 500-600 pounds respectively, by delaying harvest from the first week to the third week of September. Further delay in harvest does not improve, but may even slightly decrease yields in the event of unfavorable weather.

Peanut Nutrition Studied Under Controlled Conditions

The peanut is recognized as having habits of growth, feeding, and fruiting that are different from most other plants. If recommendations are to be made for increasing yields and improving quality of peanuts, as much

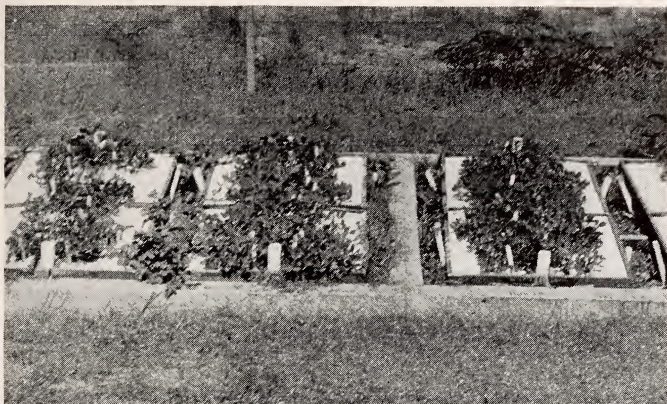


FIG. 25. GENERAL VIEW OF FRAMES USED TO STUDY PEANUT NUTRITION. THE AREA IN WHICH THE ROOTS GROW IS SEPARATED FROM THE AREA IN WHICH THE PEANUTS FORM.

as possible should be known about the nutrition of the peanut. Progress has been made in this direction through studies of peanuts under controlled conditions.

In Figure 25 are shown outdoor frames in which peanuts are being grown. These frames are so constructed that the peanut roots are separated from the fruiting area where the peanuts form. Treatments can be applied to either zone independently. By such investigations it is possible to obtain information which provides a sound basis for fertilization of peanuts.

Soils High in Organic Matter Require High Calcium Level

Making use of the frames described above, comparisons were made between two different colloids commonly found in the soils of the peanut area. Varying quantities of mineral colloid (kaolin) and organic colloid (muck) were mixed with pure sand so as to give comparable saturation

capacities with various amounts of calcium supplied.

Figure 26 shows the relationship between good fruit formation in peanuts and the nature of colloid and amounts of calcium. When the same amount of calcium is supplied by the two types of colloid, a higher percentage of good fruit is obtained in the case of the mineral colloid. This would indicate that in soils containing appreciable organic matter a higher content of calcium is required than if the soil is essentially mineral.

Bacterial Pustule and Downy Mildew Diseases Reduced by Dusting

Soybean plants were dusted four times with (a) 325 mesh sulphur, (b) 6 per cent metallic copper in talc, and (c) 6 per cent copper in sulphur. The sulphur dust failed to reduce bacterial pustule but did reduce downy mildew infections more than half. The copper and the copper-sulphur dusts decreased the number of bacterial pustule infections four-fifths or more

and reduced downy mildew infections by three-fourths or more. The copper-sulphur dust was no more effective than copper alone in the reduction of bacterial pustule but it did cause appreciably greater reduction of downy mildew.

Treatment of Soybean Seeds Improves Germination of Some Seed Lots

Dusting six lots of soybean seed with each of 11 seed treatment preparations indicates that benefits from seed treatment will be determined chiefly by the characteristics of the seed lot used and the conditions under which the seed germinate. In plantings made at Plymouth on May 2, at Rocky Mount on May 4, and at McCullers on May 9 and June 22, no one preparation consistently increased seedling stands for three of the seed lots but significant increases were ob-

tained from all of the preparations in one or more plantings of three other lots. Out of a total of twelve possible chances for increases with each seed treatment on these latter three lots significant increases in seedling emergence occurred as follows: Fermate and 2 per cent PMA, six times each; Arasan, 2 per cent Ceresan, Dubay 1452-F, Dow 5 and Spergon, five times each; 4 per cent PMC, four times; Dow 9, Dow 10, and Semesan Jr., three times each.

Nearly all of these increases occurred in the two earliest plantings where low soil temperature and moderate soil moisture caused the seed to germinate slowly. Relatively few increases occurred in the planting of May 9 where favorable temperature and abundant moisture brought the seedlings up quickly. No increases occurred in the planting of June 22

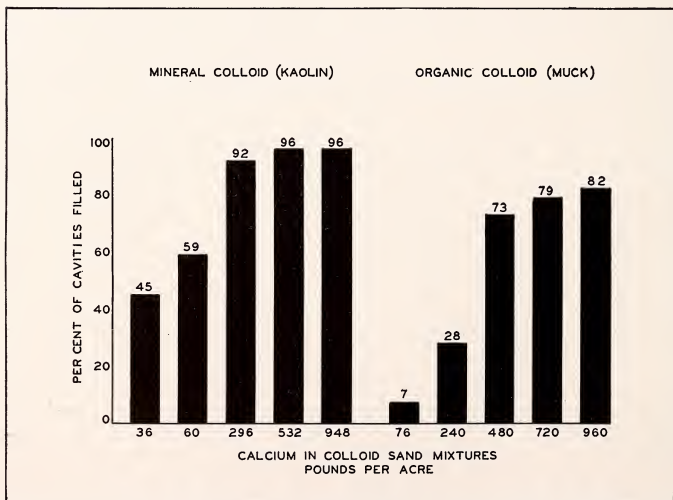


FIG. 26. A HIGHER FRUIT QUALITY OF PLANTS (CAVITIES FILLED) IS PRODUCED WHEN A GIVEN AMOUNT OF CALCIUM IS FURNISHED BY THE MINERAL THAN BY THE ORGANIC COLLOID.



FIG. 27. VOLSTATE SOYBEANS SHOWING ERECT GROWTH AND MEDIUM FINE STEMS.

where soil temperatures were high but low moisture retarded germination.

Soybean Variety Trials

Results of soybean variety trials show that the North Carolina farmer can fill his present needs with the varieties, Ogden and Volstate. In addition to high yielding ability, these varieties are definitely adapted to combine harvesting because of their seed holding, lodging resistance, and small stems (Fig. 27). Each variety has an oil content of approximately 20 per cent as compared with 17 per cent for Woods Rellow. This difference gives a 25 per cent increase in oil turnout under methods commonly used by local crushers.

For forage production, Ogden's leafy growth habit (Fig. 28 and 29) and resistance to bacterial leaf diseases make it particularly attractive. Preliminary observations indicate that

Ogden can be grazed quite satisfactorily.

Although both varieties are high yielding, high oil beans, they differ somewhat in adaptability. Ogden usually matures in early October while Volstate matures in late October, or at approximately the same time as Tokio. Over a four-year period Ogden has given slightly higher yields than Volstate on the poorly drained soils of the Coastal Plain area, however, a combination of both varieties is desirable for lengthening the combine season. On soils of the Upper Coastal Plains that are inclined to be droughty, Volstate has given better results. The two varieties have done equally well in the Piedmont areas.



FIG. 28. OGDEN SOYBEAN SHOWING LEAFY, BRANCHING GROWTH HABIT.



FIG. 29. FIELD OF OGDEN SOYBEANS PLANTED IN 42-INCH ROWS AT MCCULLERS STATION. MIDDLES COMPLETELY COVERED.

Ogden and Volstate Respond to Thicker Planting

Rate of planting tests were conducted at the Willard, Plymouth and McCullers stations to study the effect of stand upon yield in three varieties, Ogden, Volstate, and Woods Yellow.

Spacings studied were 12, 6, 3, and 2 plants per foot of row. Row spacings were 36 inches at Willard and 42 inches at Plymouth and McCullers. Table 2 reports the average yields obtained from the various spacings for each variety. Seeding recommendations for Ogden and Volstate are one bushel per acre when planted in 36-inch rows.

Potash Increases Soybean Yields

In 1944 the response of three varieties of soybeans to added potash was determined on a soil relatively low in potash in Beaufort County. One hundred pounds of muriate of potash per acre increased the yield of the

Ogden variety from 7 bushels per acre with no potash to 25 bushels (Fig. 30). An additional 100 pounds of muriate of potash increased the yield only two bushels.

The quality as measured by decayed beans, cracked seed coats, and characteristic color for variety increased to a marked degree by potash applications. The higher rates of potash increased the height of the plants (Fig. 31). The yield of the Volstate variety was increased from 5 bushels to 21 bushels per acre and the yield of the

TABLE 2

Average Yield of Soybean Varieties Planted at Different Spacings in the Row. Plymouth and Willard Data.

	NUMBER OF PLANTS PER FOOT			
	12	6	3	2
Ogden	35.3	31.5	28.4	23.9
Volstate	34.6	34.2	29.9	25.9
Woods Yellow	22.8	22.1	22.0	18.0

Woods Yellow variety was increased from 4 bushels to 18 bushels per acre with 100 pounds of muriate of potash.

The yield of soybeans without added potash on a soil high in organic matter was 31 bushels. The yield was increased to 43 bushels with 120 pounds of muriate of potash. This brings out the point that soils already producing relatively good yields may produce greater yields with additional potash if other growth factors are the same. At two locations there was no response to potash on soybeans the year following potatoes.

The muriate of potash should be applied in bands to the side of the seed at planting if equipment is available; otherwise as a sidedressing. On the two soils tested 100 pounds of muriate of potash per acre in the row under the seed before planting retarded the emergence of plants as compared with placing the potash in bands. Band

placement gave 22 and 36 per cent more plants at harvest than did the under seed placement.

Magnesium Low in Some Soybean Soils

Experiments have shown that in general soybeans respond to added magnesium on soils that contain less than 40 pounds per acre of available magnesium. As adequate potash is supplied, yields will be raised to the point on many soils where magnesium may become limiting.

Soluble magnesium increased yields of beans at several locations. At one location in Beaufort County magnesium applied in the fertilizer increased yields from 20 bushels per acre to 27 bushels per acre (Fig. 32).

The most practical way to supply magnesium to the soybeans is through broadcast applications of dolomitic

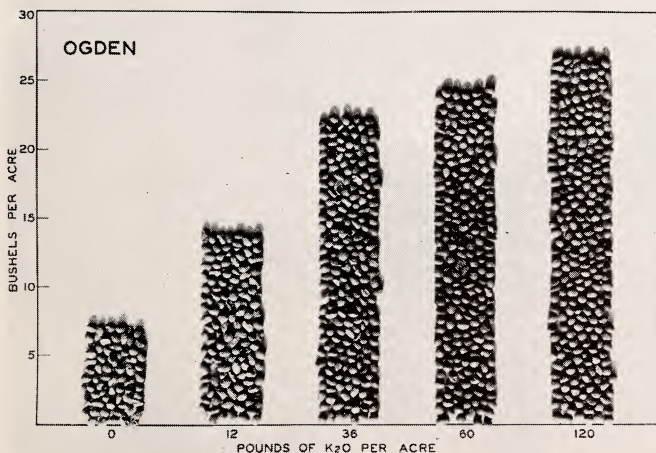


FIG. 30. YIELD AND QUALITY OF SOYBEANS IMPROVED BY ADDED POTASH (K₂O).



FIG. 31. LEFT: 60 POUNDS OF MURIATE OF POTASH; CENTER: NO POTASH; RIGHT: 100 POUNDS OF MURIATE OF POTASH ON OGDEN SOYBEANS.

limestone. Lime increased the yields of three varieties of soybeans on a Norfolk soil (Fig. 33).

The yields were limited by the lack of soil moisture, particularly at the time when the Ogden variety was setting beans. The reaction of this soil was pH 5.0. Lime should be added according to soil requirements, but 1,000 and 2,000 pounds is the usual rate of application.

Particular care should be taken to avoid overliming soils of the Lower Coastal Plain or the Tidewater area. Certain of these soils will show severe manganese deficiency symptoms on soybeans if the pH reaches 6.0. A recent experiment on an overlimed area shows that basic slag in the row supplies manganese and increases yields. A permanent remedy, however, is to broadcast and disc in sulfur on the affected area.

Minor Elements May Be Needed for Soybeans

A series of exploratory minor element experiments were located on six different fields to determine if minor elements might be needed on soybeans. Minor elements were sidedressed at the following rates per acre: Zinc sulfate—10 to 25 pounds, borax—5 pounds, manganese sulfate—25 pounds, copper sulfate—50 pounds, sodium molybdate—1 pound, and cobalt chloride—2 pounds. Adequate potash and magnesium were added on all soils.

A mixture of all the minor elements significantly increased yields on two of the soils. On the first soil, Lenoir fine sandy loam, the yield was significantly reduced when copper was omitted from the minor element mixture. On the second soil leaving the boron out of the mixture decreased yields.

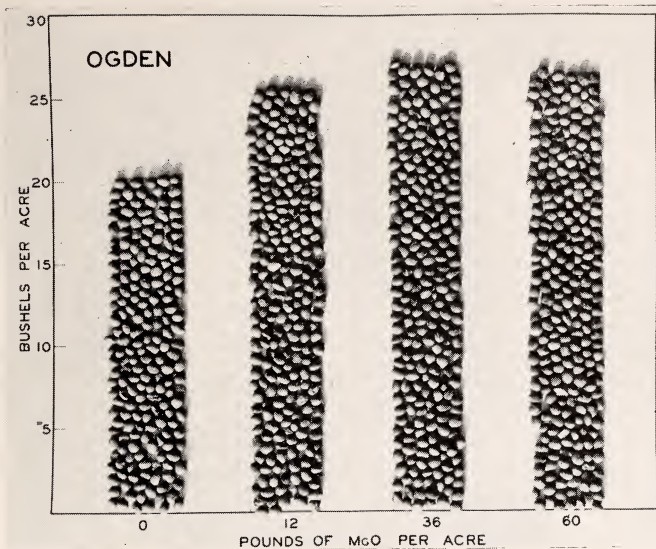


FIG. 32. SOYBEANS RESPOND TO MAGNESIUM (MGO).

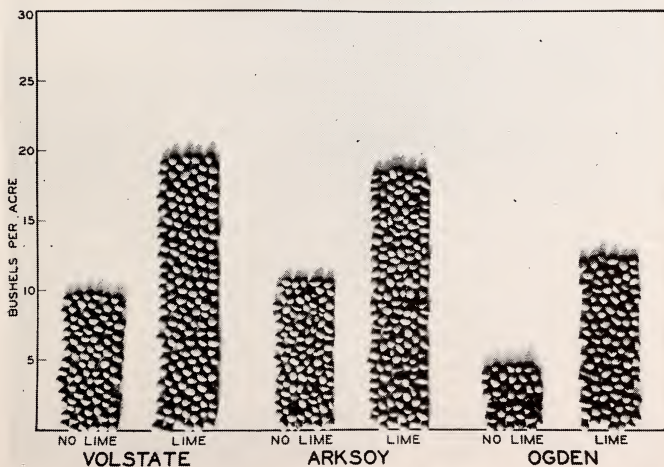


FIG. 33. LIME INCREASES YIELDS OF SOYBEANS.

SMALL GRAINS

Late Seeded Small Grains Produce Less Yields

Experiments conducted for three years at the Piedmont Branch Station, Statesville, and one year on J. J. Sander's farm, Johnston County, show that low yields of small grains are associated with late seeding (Fig. 34).

While seedings of wheat made before the Hessian fly-free date have produced slightly higher yields, there have been corresponding increases in Hessian fly infestations and damage. Results of these experiments indicate that wheat should be seeded as soon after the fly-free date as possible. This date corresponds very closely to that of the first killing frost.

Oat yields show a decline for each two weeks beyond the optimum time for seeding (Fig. 35).

At the Piedmont Branch Station a delay of six weeks, from October 1 to November 15, reduced the yield of oats from 61 bushels per acre to 26 bushels, a loss of 35 bushels per acre.

On the J. J. Sanders' farm in Johnston County, one month's delay from October 15 to November 15, reduced the yield from 68 bushels per acre to 45 bushels, a loss of 23 bushels per acre.

Small Grains Respond to Fertilizers

Ten field experiments show that the responses of wheat or other small grains to fertilizers are related to the previous cropping systems and their associated fertilizer practices.

In a system where heavily fertilized cotton has predominated on a sandy loam soil, wheat responded only to



SEEDED OCT. 15
YIELD PER ACRE
25 BUSHELS

FIG. 34

SEEDED NOV. 15
YIELD PER ACRE
18 BUSHELS

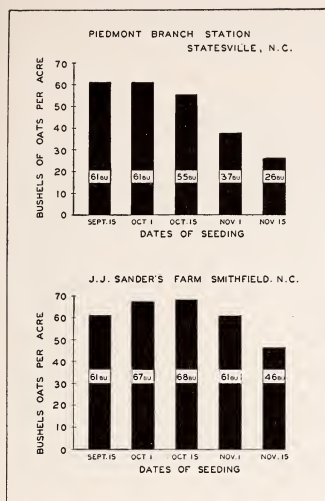


FIG. 35. DATE OF SEEDING OATS INFLUENCES THEIR YIELD.

nitrogen. Wheat grown in a rotation of wheat, sweet clover, and corn on a Davidson clay loam soil, which has been lightly fertilized, responds to phosphoric acid and potash (Fig. 36).

A large part of the acreage seeded in small grains is in cropping systems which are lightly fertilized. Under these conditions small grains respond to both a complete fertilizer at seedling and to a topdressing of nitrogen in the early spring (Fig. 37).

The profit derived from topdressing small grain with nitrogen is dependent upon the increase in yield that it brings and the cost of the topdressing materials.

The first 15 pounds of nitrogen added produced greater increases in these experiments than did the two succeeding increments (Fig. 38).

New Winter Oats Introduced For the Piedmont and Mountain Sections

The most promising new winter hardy oat selection developed by the Experiment Station in recent years is one from a cross of Winter Fulghum x Lee, No. 1083B2-1.

As an average for nine tests conducted over a six-year period, five at the Piedmont Station and four Official Variety Tests, this new strain has averaged 77.7 bushels per acre as against 69.1 for Fulwin, 66.5 for Lee 5, 63.9 for Fulgrain 3 and 62.0 for Letoria. This is an increase of 17 per cent over Lee 5, the standard variety in this area for many years.

This oat is not resistant to crown rust or to smut, except for certain races of smut. It is, however, quite winter hardy and should be tried rather widely as a replacement for Lee and Fulwin. It is being increased for limited distribution in 1945.

In 10 official tests conducted in the Coastal Plain in the past three years, leading varieties produced the following yields: Stanton, 82.2; Victorgrain, 79.1; Fulgrain 3, 78.0; and Letoria, 77.4.

Mosaic, A New Oats Disease

Mosaic of oats was observed in 1944 in a number of the Southern states including North Carolina. Letoria and Lelina, two of the better rust and smut resistant varieties, were attacked by this new disease as were many others.

Just how the disease is spread is not known but it seems evident that there are varietal differences. Fulwin, for instance, seems to have been little affected. Fortunately, the 1943-44 nursery included a large group of selections from a cross of Letoria x Fulwin, many of which appeared resistant to the disease and produced as well or better than Fulwin. But



FIG. 36. WHEAT RESPONDS TO PHOSPHORIC ACID AND POTASH.

WITHOUT PHOSPHORIC ACID AND POTASH	WITH PHOSPHORIC ACID AND POTASH
15.8	28.2
BUSHELS PER ACRE	BUSHELS PER ACRE

others were as badly affected as was Letoria.

A nursery is being grown in 1944-45 to observe the reaction of some 90 varieties to this disease. The best of the selections from the Letoria x Fulwin cross referred to above are also being studied.

The possibility of this disease being related to nutritional deficiencies is also being studied by workers in the Department of Agronomy.

Sunrise Type Barley Has High Yield

Of 25 strains of barley tested in each of the past three years at the Piedmont Station six were of the Sunrise type. These six strains ranked 1 to 6 as an average for the three year period, exceeding in yield all

strains of rough awned, and hooded barleys.

Notes on the yield nurseries would indicate that the mildew resistance and general vigor of this group of barleys are the important factors contributing to their performance record.

Notes on the yield nurseries would indicate that the mildew resistance and general vigor of this group of barleys are the important factors contributing to their performance record.

One of these strains, Sunrise 23 exceeded Sunrise slightly in each year of the three-year period and may eventually succeed it. Another important observation made on Sunrise barley during the year was that it carried some resistance to aphids. In a test of 42 strains at the Mountain

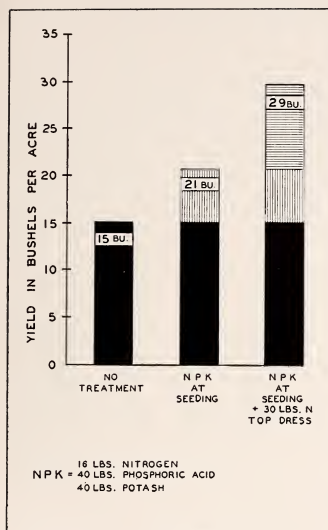


FIG. 37. WHEAT YIELDS INCREASED FROM COMPLETE FERTILIZER AT SEEDING AND FROM TOPDRESSING IN THE SPRING. (AVERAGE YIELDS OF EIGHT EXPERIMENTS—1944.)

Station all but three were almost completely destroyed in the fall. Sunrise, Wong and Calhoun partially survived the attack.

Other promising material being tested is a group of mildew resistant selections from crosses of Sunrise x Hooded 26, Sunrise x Hooded 16, and Sunrise x Davidson. In preliminary tests in 1942-1943 and in advanced yield tests in 1943-44 several of these exceeded Sunrise.

Progress in Developing Disease Resistant Wheats

Three leaf rust resistant selections from the cross Malakoff x Nittany have ranked 1, 2, and 3 in the wheat yield trials at the Piedmont Station

as an average for the past five years.

In all 11 Piedmont tests, including the above five plus six Official Variety Tests, strain 3 from this cross has averaged 33.9 bushels as compared with 31.5 for Nittany. The rank of all strains included in these 11 tests were as follows: Hardired, 34.9; Malakoff x Nittany Strain 3, 33.9; Redhart, 31.6; Nittany, 31.5; Carala, 30.9; and Leap, 30.2.

The bulk hybrid from which these Malakoff x Nittany selections came has been grown at Statesville since 1931. In the heavy rust years of 1934, 1935 and 1937 this hybrid showed 2 to 5 per cent infection as against 30 to 100 per cent for Leap and about 30 per cent for Nittany. The new selections have been found equally resistant to rust and also somewhat resistant to mildew. In the spring of 1944 at both Statesville and McCullers they were found to be semi-resistant to mildew in tests where Purplestraw and Carala were completely susceptible.

Malakoff x Nittany strain 3 has a wide range of adaptation and will probably be used to a considerable extent as a rust resistant parent in future breeding work in several eastern states. In North Carolina it should be tried rather widely in the Piedmont and Mountain areas as a replacement for Fulcaster.

In this Station's breeding program the most promising new material is a group of mildew and leaf rust resistant selections from a cross of Fron-dosa x (Redhart x Noll), the original material being received from the Division of Cereal Crops and Diseases in the fall of 1941. Several of these produced very heavy yields in 1943-44, in comparison with Carala. This material makes a valuable addition to the breeding program, but is not available for immediate use by grower.

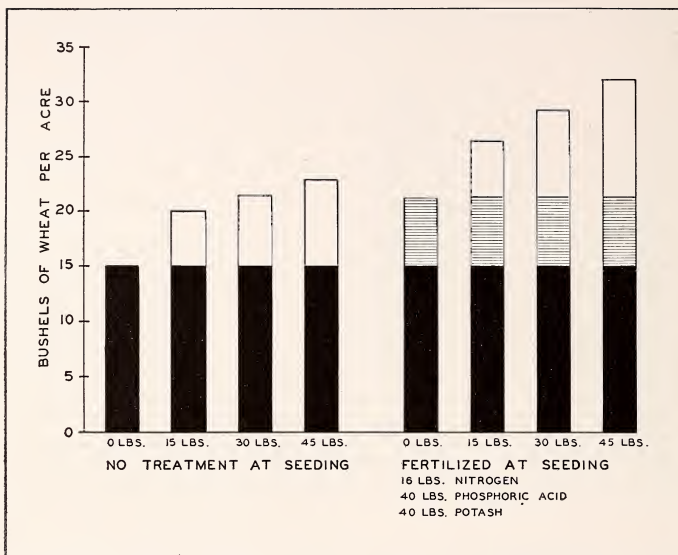


FIG. 38. TOPDRESSING SMALL GRAIN WITH NITROGEN INCREASES THEIR YIELDS. (AVERAGE YIELDS OF EIGHT EXPERIMENTS—1944.)

For the present, farmers in the Piedmont area should choose their varieties from the list discussed above.

Abruzzi and Balbo Rye Are Good Grazing Crops

Rye produced more forage during the fall and winter than did any other small grain on a well drained, sandy loam soil of the Upper Coastal Plain. Of the barleys, and of the ryes grown, results during 1943-44 indicate that Abruzzi makes more growth during the fall and winter than Balbo but that Balbo is more productive during the spring. Grain yields, however, were approximately the same for the two varieties.

The Abruzzi rye would have carried one cow per three acres during

November and December, and one cow per two acres during January and February. During March the Balbo rye would have carried two cows per acre.

Simulated grazing through mowings did not result in less grain yields if it was discontinued at the end of December, but if it continued through February, the yields were a little more than half as large. Whether or not rye should be grazed during the late winter and early spring months would depend upon the relative needs and supplies of roughage and concentrates on the farm. Any appreciable fall and winter grazing is dependent upon early seedings and liberal applications of nitrogen to the small grains.



FOREST GRAZING

First year results for forest grazing in Piedmont forest types (Fig. 39) showed that in a moderately grazed woods pasture yearling steers made average daily gains of over one pound. This result was obtained through a seventy-day period from April 18 to June 27 at a grazing rate of six acres per head. In the same period, yearlings on a less favorable pasture grazed at the rate of $4\frac{1}{2}$ acres per head made average daily gains of only $\frac{1}{2}$ pound.

The timber types represented in these grazing results are commonly found in Piedmont woods pastures. The types are: Mature pine, bottom-land pine-hardwood, pine hardwood

reproduction ranging in height from 3-15 feet to 12-30 feet, pine poles in size classes up to 6 inches d.b.h.,¹ and a loblolly pine plantation established in 1938.

Damage to trees was dependent on the rate of grazing and on the timber type, ranging from 46 to 72 per cent for black gum, yellow poplar, and white ash for trees 1 inch d.b.h. and smaller in the more intensively grazed pasture. But in the less intensively grazed pastures the damage percentages ranged from 9 to 32 per cent. Red gum and red maple, two of the most common species of reproduction,

¹ Diameter at breast height or $4\frac{1}{2}$ feet above the ground.

FIG. 39. CATTLE GRAZING ON A FOREST RANGE IN THE PIEDMONT AREA.

averaged 16 per cent damage under intensive grazing, but only about 4 per cent under moderate grazing.

There was no apparent damage to pine reproduction in any of the timber types or for any size class.

The steers preferred herbaceous forage and vines such as honeysuckle to tree browse. At the start of the grazing season only the most palatable trees such as yellow poplar and white ash were damaged at all. Toward the end of the grazing period, however, when forage was becoming very short, the rate of browsing on hardwoods increased greatly.

At the end of the grazing period there was a pronounced reduction of the readily burnable fuel in the more heavily grazed areas. Even in the moderately grazed portions of the pastures the fire danger had been reduced, judged on the basis of fuel available to support surface fires. By fall, however, considerable regrowth

had occurred and the chances for damaging fires increased.

A Weather and Fire Danger Station

A weather and fire danger station has been established in the Hofmann Forest at the Deppe Tower, about 9 miles northeast of Jacksonville on U. S. Highway 17.

The first instruments were mounted during October and set in operation on November 1, 1944. Instruments in operation are: anemometer, wind vane, sunshine duration transmitter, tipping bucket rain gauge, barograph, air thermograph, soil thermograph, and maximum and minimum thermometers for air temperature.

A hygrograph, standard rain gauge, evaporation tank with hook gauge, and soil water level recorder are yet to be installed.

This station will aid in gathering data needed to establish the relationship between weather and forest fire danger.



SMALL FRUITS

Drought Resistant Dewberries

One of the greatest losses of the dewberry grower is that of having his crop dry up on the vines at or just before harvest. The trouble is caused in part by cane injuries and diseases which prevent the normal movement of water through the canes. This reduction in water movement becomes especially critical during periods of dry weather and high temperature, which frequently occur just as the fruit is ripening, when the demands of the plant for water are greatest.

As the 1944 season was especially severe in regard to low moisture and high temperature at harvest time, it

was a good time to test the resistance of berry selections developed in the breeding program.

Standard varieties such as Lucretia and Youngberry suffered severely and approximately half of their crop was unmarketable. Some of the selections, however, maintained healthy green foliage throughout harvest and matured full crops of normal berries, due in part to their resistance to cane diseases and in part to the superior vigor of their root systems, as well as of their canes.

Similar differences in vigor were again evident in the fall after an unusually dry summer. By the first of October, Lucretia plants averaged

FIG. 40. DEWBERRY SELECTION 38-7-3, SHOWING LONG, STRONG CANES WITH HEALTHY FOLIAGE.

only 38 feet of cane growth per hill and were badly defoliated. In contrast to this, most of the better selections had produced 70 to 80 feet of cane growth per hill with little or no defoliation (Fig. 40).

Calcium Content of Strawberry Plants Affected by Degree of Calcium Saturation in the Soil

Experiments in 1944 indicated a relationship between the total weight, total calcium and the percentage of calcium in the strawberry plant (Fig. 41).

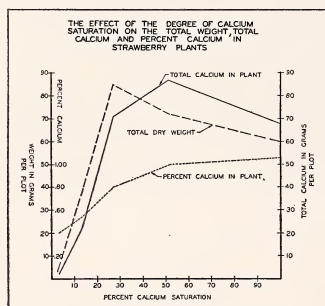


FIG. 41.

In the experiment reported here for the Blakemore variety, a response in growth was obtained up to a point where the soil was 25 per cent saturated with calcium. This was accompanied by an increase in the percentage of calcium in the plant.

Blakemore-Massey Combination Still Good in Eastern North Carolina Tests

Out of a total of 25 strawberry varieties and hybrids tested at the Coastal Plain Branch Station at Willard, none outyielded Blakemore or Massey in 1944.

Of the eight varieties in the test,

the yields of Konvoy, Missionary, and Tennessee Shipper were equal to those of Blakemore and Massey, but the berries of Konvoy and Missionary were rather soft for satisfactory shipping qualities. Fairmore, Klommore and Konvoy were earlier than Blakemore, and Tennessee Shipper was later than Massey. The berries of Tennessee Shipper were smaller than were those of any other variety or hybrid.

Of the 17 hybrids tested, the yields of seven were equal to those of Blakemore and Massey, while three were earlier than Blakemore and two later than Massey. Four hybrids produced berries as large as those of Massey.

Age of Plant Determines Strawberry Yields

Plants of the Blakemore strawberry set in early spring, generally referred to as mother plants, produced 50 per cent more berries than did runner plants rooted in June, and 100 per cent more berries than those rooted in September. At Willard the mother plants yielded at the rate of 5,197 quarts per acre, compared with 3,776 quarts for June runners and 2,188 quarts for the September runners. At McCullers the yield per acre for mother plants was 10,532 quarts, for June runners 7,903 quarts, and for the September runners 5,235 quarts (Fig. 42). The crop was earlier and the berries were slightly larger on the September runners, but these advantages were outweighed by the greatly increased yields from the older plants. The yields were reduced at the Willard Station by late spring frosts.

These results indicate the need in first-year beds for care in saving mother plants and for close attention to the rooting and protection of early summer runners if highest yields are to be obtained the following spring.

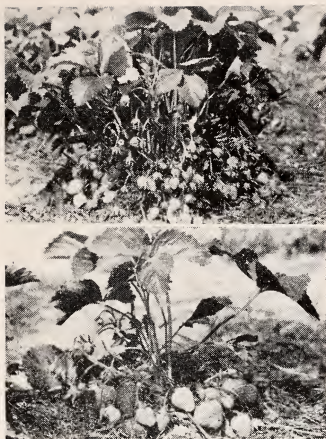


FIG. 42. ABOVE, PLANT OF BLAKEMORE STRAWBERRY SET IN MARCH, 1943. BELOW, RUNNER PLANT OF BLAKEMORE ROOTED IN SEPTEMBER, 1943. BOTH PHOTOGRAPHED IN MAY, 1944.

Lime-Sulphur to Control Blueberry Mites

Lime-sulphur at the usual summer strength (1 part of concentrate to 40 parts of water) has given the most consistent control of the blueberry

bud mite, *Eriophyes vaccinii* Keifer, when applied in July just after the crop is removed.

The mite does not injure the plants at that time but it becomes destructive during the dormant season and during early spring, when it badly injures many of the fruit buds. In early July, however, there are no winter buds and the mites are more exposed to the spray.

Dormant sprays have given good results only if applied in November or early in December. At that time the mites are mostly confined to the outer bud scales. Later they penetrate to the interior of the bud where no spray can reach them. A soluble dinitro dormant spray (Elgetol) has given the best control of the dormant sprays tested, when used at the rate of 5 parts of the commercial product (34 per cent active ingredients) to 1,000 parts of water to which has been added 1 part of a wetting agent (Tergitol 7).

The activity of predatory mites has kept the bud mite under partial control in local areas for the past few years, and the general use of lime-sulphur as a summer spray cannot be recommended unless the mite again becomes destructive.

TRUCK CROPS

Surplus Irish Potatoes for Silage

The making of silage from surplus and cull Irish potatoes has been investigated at the Central Experiment Station at the request, and through the cooperation of, the War Food Administration. This study was undertaken to provide an outlet for the large surpluses of this crop in 1944 and to help in meeting the critical need for stock feed.

For tests with raw potatoes a mix-

ture of five parts potatoes and one part alfalfa hay by weight were chopped with a silage cutter and ensiled in a small upright silo. The hay was added to supply bulk so that the chopped material might be blown into the silo in the conventional manner (Fig. 43). The hay also served as an absorbent for liquid which would drain away from chopped raw potatoes during and following ensiling. No difficulty was encountered in preparing the silage in this manner.

The steamed potatoes were ensiled whole, in a cement-plastered trench silo. Steaming was done in steel-bodied dump trucks on the bottoms of which steam coils were attached. Each coil consisted of four parallel lengths of perforated pipe connected to a horizontal cross member and attached to a vertical intake just back of the cab. A steam hose served to connect the coil to a steam line.

Approximately two tons of potatoes were dumped into each truck, covered with heavy canvas and steamed until cooked, which required about 45 minutes. They were hauled immediately to the trench and dumped. When the trench was filled, it was covered with roofing paper followed by a six-inch layer of soil.

Samples of the steamed potato silage have been taken at frequent intervals during the six months period since the silo was filled, and bacteriological and chemical observations have been made. The product

possesses good texture and odor, and the quality of the ensiled material is considered to be good. Feeding tests have been planned on both types of silage.

High Temperatures Make Potatoes Susceptible to Bacterial Soft Rot

The results of a number of laboratory and field experiments have shown that exposure of potatoes to direct sunlight or high temperatures increases their susceptibility to bacterial soft rot.

On June 20, 1944, a heat injury experiment was conducted near Aurora. The procedure consisted of plowing up the potatoes and shaking the tubers from the vines, leaving them exposed to the sun by 8 a.m. One hamper of potatoes was picked up immediately and placed in the shade. Throughout the remainder of the day potatoes were picked up at one or two hour intervals and placed



FIG. 43. CHOPPING A MIXTURE OF RAW IRISH POTATOES AND ALFALFA HAY WITH AN ORDINARY SILAGE CUTTER.

in the shade. Tuber temperatures were measured at the same intervals of time. About 7 p.m. all samples were taken to a grading shed and run over a potato grader. They were then stored in a dry, well ventilated room. The following morning the last sample was picked up, (7 a.m.) run over the grader, and placed with the earlier samples.

Those potatoes picked up immediately after digging remained healthy after one week's storage. Those gathered at progressively later hours rotted in increasing amounts. This relationship held until 2 p.m. when the potatoes had attained a maximum temperature, and all potatoes picked up at this time rotted. Those samples picked up for the rest of the day all rotted even though the average potato temperature at time of picking fell 23° F. This suggests that the tubers were probably injured by the higher temperatures before 2 p.m. The sample picked up the morning of June 21 (24 hours after digging) rotted to the extent of 63 per cent. This lower percentage of rot suggests that the tubers had partially recovered from the heat injury of the previous day. The potato samples were in storage for one week before being examined for rots.

Laboratory experiments indicate that the increased susceptibility is associated with a change in cell membrane permeability. When potatoes were cut into small pieces and placed in water it was found that the sugar concentration of the water containing the potatoes progressively increased from potatoes stored above 90° F. The diffusion of sugar from potatoes stored at this temperature or above is closely correlated with the development of bacterial soft rot in graded potatoes held at the same temperatures.

Chemical Soil Treatments Show Promise for Controlling Southern Bacterial Wilt of Irish Potatoes

Successful control of Granville wilt and other diseases by treating infested soil with chemicals suggested the possibility that such treatments might be effective in controlling southern bacterial wilt in the Eastern North Carolina Irish potato areas.

In January and February, 1943, replicated plots laid out on a wilt-infested area were treated with the following chemicals at the indicated rates per acre: Lime, 5,700 pounds; sulphur, 2,000 pounds; lime followed by urea (Uramon), 10,000 pounds and 1,000 pounds; ammonium thiocyanate, 1,000 pounds; and control (no treatment).

Ammonium thiocyanate severely injured the first seed pieces planted and a second planting was made the last of April. The plants on the sulphur plots were stunted, yellowish and produced heavily corked and russeted tubers. When this crop was harvested there were no wilt-diseased plants in the ammonium thiocyanate plots and the lime-urea and sulphur treatments appreciably reduced the incidence of disease. The treated plots grew to weeds during the summer of 1943 following potato harvest. In November the sulphur plots were treated with 4,650 pounds of lime per acre.

In 1944, two test rows were planted through the center of each plot. Diseased plant readings made in June, 1944, are shown in Table 3.

As shown in Table 3 the two treatments, sulphur-lime and ammonium thiocyanate gave effective control of southern bacterial wilt. The lime-urea treatment was less effective and the amount of lime used may have been more than was needed for effectiveness. The sulphur-lime treatment is

TABLE 3
Average Number of Plants Showing
Symptoms of Southern Bacterial
Wilt, June, 1944

Treatment	Plants showing wilt symptoms (ave. number)
Lime	68.0
Sulphur-Lime	0.4
Lime-urea	16.0
Ammonium thiocyanate	2.2
Control (untreated)	53.0

probably too expensive when used on soils high in organic matter. There are, however, wilt-infested soils in Eastern North Carolina that possibly would show a reduction in disease if treated with 1,000 pounds or less of sulphur per acre.

Ammonium thiocyanate treatment looks promising and experiments using lower concentrations are in progress. It is possible that treatments with this material made in October or November using lower dosages might show less toxicity to crops planted the following spring than was obtained with the January-February treatments. Ammonium thiocyanate is not available for commercial use at present. However, it is possible that effective treatments can be worked out by the time that the material is available.

Minor Elements Affect Irish Potato Yields

To determine if there was a need for minor elements in the Irish potato area, a series of exploratory experiments was laid out. A mixture of boron, zinc, manganese, copper, and magnesium compounds was side-dressed in two applications, once just after planting and again when the plants were four to six inches high. This was done at five locations.

On one of the fields the yield with minor elements was 102 bags of No.

1's per acre. Where they were left off the yield was 85 bags. This increase was obtained when the pre-planting application of fertilizer was 1,200 pounds of 6-8-6 per acre and no increase from the minor elements was obtained when 2,400 pounds was used. Smaller increases in yields were obtained at three of the other locations.

New Insecticides for Potato Insect Pests

Experiments on the control of potato insect pests has demonstrated the effectiveness of certain new insecticides against the Colorado potato beetle, the potato flea beetle, and the potato leafhopper.

Of the newer poisons used, DDT in dust form proved to be most effective in the control of the Colorado potato beetle, both adults and larvae.

DDT is the abbreviated designation for the compound known chemically as dichloro-diphenyl-trichloroethane. A dust containing 3 per cent of DDT and 97 per cent of inert filler gave excellent control of this pest.

Examination of plots (80 hills) 24 hours after dusting showed an average of three dead adults for every two hills. At the time of dusting there was approximately one egg cluster, averaging 30 eggs, to every two hills. Some of the eggs began hatching within two to three days after dusting. However, three weeks after dusting with the 3 per cent DDT there were only four larvae and four adults on 80 hills. Foliage of the treated hills showed that no damage resulted from insect feeding or from insecticidal action. However, liquid DDT (5 per cent) 1 part to 200 parts of water did not effectively control the feeding of adults or larvae.

Tests for the control of potato flea beetles and leafhoppers showed that plots treated with 3 per cent DDT

dust yielded more potatoes than did any of the plots treated with other insecticides. Dinitro-o-cyclohexylphenol dust gave a good knock-down of flea beetles, but yields from plots thus treated were not very high. A dust mixture of synthetic cryolite and dinitro-o-cyclohexylphenol gave fair control of flea beetles and leafhoppers, and yields from plots treated with this mixture ranked next to the 3 per cent DDT treated plots.

Dinitro-o-cyclohexylphenol has some possibilities in the control of flea beetles and leafhoppers. Further experimentation with this compound should indicate its effectiveness in the control of these pests.

Drying Surplus Irish Potatoes

Following tests made with the State College pilot-scale dehydrator at Raleigh, a commercial procedure was developed for the large-scale drying of Irish potatoes in a tobacco redrying plant through the courtesy of the G. R. Garrett Company, Inc., of Rocky Mount. Purpose of the study is to determine the value of dehydrated potatoes for use in stock feeds.

According to this procedure the potatoes were washed, cut into slices 1/16" x 3/8" and dried on the continuous belt of the tobacco redrying machine. No alteration of the machine was required for its use in drying potatoes, other than slowing the belt speed.

Potatoes were dried at the rate of one ton of fresh material per hour. The dried product was stored in burlap bags in a dry barn or shed without spoilage. Stock feeding tests of the dried product have been planned.

Nutritive Value of Brined Vegetables

Corn, snap beans, English peas, okra, celery, and cabbage are among the vegetables that have been salted or brined. They are important in the

diet as varied sources of protein, starch, minerals and vitamins. Investigation of the retention of the nutritive values of brined vegetables has been found to be dependent, in part, upon the brining methods followed.

It has been found that the use of brined vegetables so that desalting is not required, will result in the greatest conservation of the nutrient constituents of the vegetables. In the absence of desalting, the total protein retention is high and mineral losses are small; carotene retention is fair and thiamin and riboflavin may be present in significant amounts. Vitamin C (ascorbic acid) is well retained in certain brine-preserved vegetables and largely lost in others, depending on the brine procedure followed. In sauerkraut, Vitamin C retention is good. Kraut that has been properly made and carefully packed and stored is a good source of this vitamin.

When desalting is practiced in the preparation of brined foods for table use, somewhat greater losses in proteins and minerals may be encountered. The desalting operation will effectively reduce the concentration of sugars, Vitamin C and probably the B vitamins to a very low level. Such losses will be in keeping with the degree of dilution required to reduce adequately the salt content for table use.

Tomato Selection Resistant to Bacterial Wilt

In field tests during the summer of 1944, three of the tomato lines selected for resistance to Bacterial Wilt (*B. solanacearum*) lived 100 per cent.

Seeds of one of these lines, the fifth generation from the cross Louisiana Pink x T414 (*Lycopersicum esculentum* from Porto Rico—P. I. No. 3814), were planted in the greenhouse during the summer months. Along with

this, a susceptible variety, Scarlet Dawn, was planted. These were potted and on August 28 inoculated with the Bacterial Wilt organism. Figure 44, taken sixteen days later, shows how the variety Scarlet Dawn wilted as compared to the selected line from the Louisiana Pink x T414 cross.

Production of Cabbage Seed Successful

Tests conducted at the McCullers Station in 1943-44 indicate that cabbage seed can be successfully produced in this area.

Three varieties, Marion Market, Danish Ballhead, and Glory of Enkhuizen, were planted on July 18, August 1 and 16, and September 4. The August 1 planting gave best results on all varieties; the average yield of

seed per acre being 465 pounds. Germination tests were satisfactory.

To determine the possibility of utilizing the heads that formed on many of the plants, every other plant was cut in early December, leaving the stalk and a few basal leaves. This resulted in severe damage by freezing on the uncut heads, running as high as 30 per cent in the variety Marion Market.

Cucumbers for Pickling

Tests of more than twenty varieties of pickling cucumbers were made with cooperating growers in Eastern North Carolina and at the McCullers Station. The varieties were compared with respect to productiveness, season, appearance and suitability for pickling. Ten other varieties of the larger type cucumbers were also grown for observation in these tests during four different seasons. Of the pickling types of cucumbers deserving special consideration by North Carolina growers and packers, five appear outstanding in several respects.

National Pickling, which has been the leading variety in the past, was unexcelled in general appearance of the fresh cucumbers and usually produced a good quality pickle. It is still considered the standard variety in many regions.

Earliest of All, a small white spine type, was much more productive than National Pickling. The brined and the pickled cucumbers were equal to National in firmness and were superior in color. Cucumbers of the Earliest of All variety, however, tend to be rather pointed as small pickles, which is considered undesirable for packing in the usual glass jars.

White Spine Hybrid vines showed remarkable vigor and gave good yields. The cucumbers have good color and uniformity. However, the ratio of length to diameter is greater than that

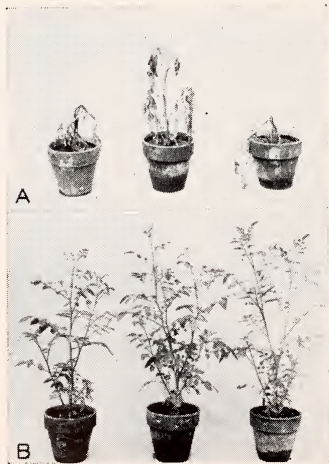


FIG. 44.

- A. SCARLET DAWN 16 DAYS AFTER INOCULATION WITH BACTERIAL WILT.
B. RESISTANT SELECTION OF LOUISIANA PINK X T414 16 DAYS AFTER INOCULATION WITH BACTERIAL WILT.

of the usual pickling sorts and this variety may prove more valuable for use in sliced products such as the fresh cucumber pickle.

Mincu was outstanding in the prolific set of fruit, often as many as eight cucumbers being formed at a single node. This variety provides suitable material for midget or "gherkin" pickle manufacture. Unfortunately, the larger or dill sizes are too short and round for packing in the usual jars and they are less firm than National cucumbers of the same size. A desirable feature of Mincu is its early season, the vines bearing heavily at least a week before National and several days before Earliest of All.

The Stays Green type produces larger sized cucumbers, which are more useful for manufacture of dill pickles. The retention of a dark green color is an advantage where the usual types are too pale. As this variety is much less prolific than Mincu, commercial packers who intend to pack a large proportion of their stock as small sour or sweet pickles would not be interested in it.

Cauliflower Grown Successfully as Fall Crop

A fall crop of cauliflower was produced successfully at the McCullers Station in 1944. Five varieties were grown to determine their adaptability to local conditions.

The yields of marketable cauliflower varied among varieties from 1,481 to 5,447 pounds per acre. The three better varieties were Improved Super Snowball, which produced 5,447 pounds per acre, Early Snowball with 5,295 pounds and Burpeeana with 4,435 pounds. The average weight per head after trimming was 1.14 pounds for Improved Super Snowball (Fig. 45), 1.02 pounds for Early Snowball, and 0.84 pounds for Burpeeana.

The seed were planted in the college greenhouses on June 16 and the plants set in the field on July 21. These plants received the same cultural treatment as collards. In spite of boron deficiency that developed in some of the plants, satisfactory growth was made.

Cutting of the earlier varieties began on October 19 and the heads continued maturing until a heavy freeze the latter part of November.

Promising Treatments for Lettuce Damping-Off

In further tests on the control of post-emergence damping-off in lettuce plant beds in 1944, two organic fungicides, thiosan and fermate, showed considerable promise. These materials were included in tests at three locations in the lettuce area and gave fair to excellent control, without causing appreciable injury to the plants.

Both materials were applied as drench treatments at the time of seeding and at 10- to 14-day intervals throughout the plant bed season. In plots receiving six applications of thiosan at 2 grams, or fermate at 8 grams, in $\frac{1}{2}$ gallon of water per square yard, little or no disease developed, while up to three-fifths of the plants in check plots were destroyed. In one test in a commercial bed, four applications of thiosan or fermate, applied after damping-off had started, completely checked the disease, while untreated portions of the bed were a total loss. Further rate and time of application tests with these materials are under way.

Pre-seeding treatments with sodium nitrite continued to show promise in 1944. At nine ounces per square yard, applied six weeks before seeding, this material gave about 90 per cent control, but caused some reduction in stands.

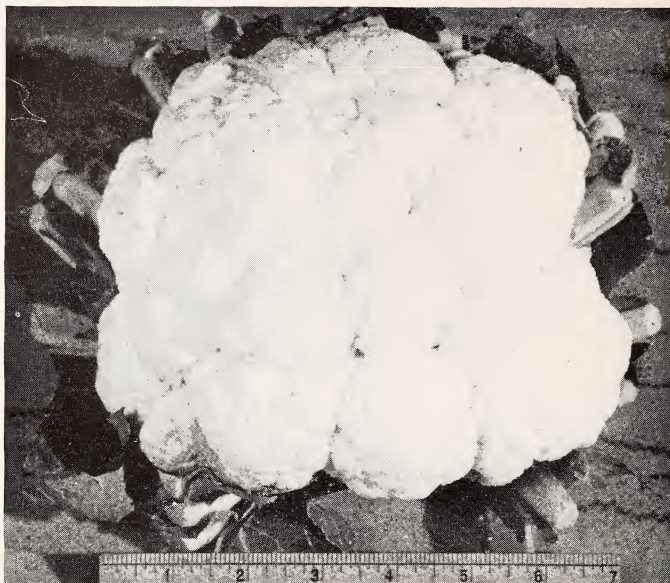


FIG. 45. A HEAD OF IMPROVED SUPER SNOWBALL CAULIFLOWER GROWN AT THE MCCULLERS STATION. WEIGHT $3\frac{1}{2}$ POUNDS.

Proper Timing of Control Measures For Pea Aphid

The proper timing of the application of insecticides for the control of the pea aphid is of the utmost importance.

Observations in Eastern North Carolina during the past two years have indicated that if aphids are present on pea plants they should be dusted with rotenone or nicotine dusts when the first pods are forming. In years of heavy aphid infestations it may be necessary to make two applications, however, one is usually sufficient in Eastern North Carolina.

Further Studies on Controlling Root Knot of Vegetable Crops

Soil treatments with sodium nitrite and uramon continued to give a rather high degree of root knot control in tests at the McCullers Branch Station.

In second year plantings on plots treated in the spring of 1943, sodium nitrite at $\frac{1}{2}$ pound and uramon at $\frac{1}{2}$ and 1 pound per square yard were still highly effective, but root knot increased considerably in plots treated with sodium nitrite at only $\frac{1}{4}$ pound. There were no significant differences in yields of snap beans or okra on treated and untreated soils, but yields

of squash were less from untreated areas than from the treated at both $\frac{1}{2}$ and 1 pound applications and, at the $\frac{1}{4}$ pound nitrite rate, tomato yields were reduced.

Uramon, applied in the fall, gave slightly less effective root knot control than did sodium nitrite or chloropirrin. In this test yields of bean, squash, okra and tomato were significantly higher for chloropirrin than for the other treatments. This treatment also gave higher yields of okra and tomato than the untreated controls.

In plots treated in the spring of 1944 and planted six weeks after

treatment, sodium nitrite ($\frac{1}{4}$ and $\frac{1}{2}$ pounds per square yard) and uramon ($\frac{1}{2}$ pound per square yard) again gave good control and root knot readings were essentially in agreement with those of the previous year. However, stands and yields were adversely affected by these treatments.

While both uramon and sodium nitrite appear to be as effective or nearly so against root knot as chloropirrin, this material has given better yields, possibly due to its greater effectiveness against other disease organisms and to adverse effects from the other chemicals not yet fully understood.

PEACHES

Ethylene Dichloride Emulsion Is Safe For Treating Peach Trees

Experiments conducted on two-year-old trees at Eagle Springs (Moore County), 1942-1944, indicated that ethylene dichloride emulsion was safe to use for peach tree borer control in sandy soil.

The emulsion was poured on the trees in all the experiments, $\frac{1}{8}$ pint being used in 1942 and $\frac{1}{4}$ pint in 1943. Trees treated with 30 per cent ethylene dichloride emulsion did not show any injury but those treated with a 50 per cent emulsion showed some flecking in the cambium but no continuous injury in the cambium nor any injury to the wood. The 70 per cent and 90 per cent emulsions caused some continuous browning of the cambium as well as some injury to the wood. However, after treating these trees two consecutive seasons, there was no significant difference in the appearance or the growth of the trees which were not treated and those receiving the various concentrations of ethylene dichloride.

On heavy clay soil at Raleigh, 1942-44, the results on one-year-old trees were quite different. Some trees treated with $\frac{1}{8}$ pint of emulsion containing 40 per cent ethylene dichloride or more were killed. Trees receiving a 30 per cent emulsion showed signs of injury in the cambium but not in the growth nor appearance of the tree. None of the trees treated with an emulsion containing 20 per cent ethylene dichloride or less showed any signs of injury.

The results indicate that ethylene dichloride emulsion is safe to use on peach trees in North Carolina when it is used at the recommended concentrations and dosage.

The Use of Minor Elements in Sandhills Peach Orchards

Over a period of ten years, tests with minor elements on peach trees in the Sandhills have failed to give sufficient response to recommend their general use. The principal minor elements used included magnesium, manganese, iron, copper, zinc and boron.

During 1944 this work was expanded to cover more of the commercial peach area and to include additional materials and combinations.

The pH level of the soil in these tests is being adjusted with the use of lime, since the availability and need of these elements is associated with the acidity of the soil. The materials are being applied alone and in combination both directly to the soil and as nutrient sprays. Determinations made include analysis of the soil and plant.

One of these materials, boron, has given a definite response. This has affected the time of bloom and of ripening and the size and quality of the fruit. Since some of the effects have not been desirable and because they may be due in part to injury factors, no recommendations can be made at this time for the use of boron on peach trees. None of the other materials has thus far given indication of beneficial effect for general orchard use. Treatments are being continued and new combinations tried since the response is often slow, and cumu-

lative, as well as seasonal in occurrence.

The use of minor elements may result in more efficient use of the ordinary fertilizer elements, but cannot be expected to overcome results caused by neglect of good soil and tree management.

One Hundred Peach Varieties

A planting of 100 peach varieties has been made at the Sandhills Peach Research Laboratory near Eagle Springs. Forty-eight varieties fruited in 1944 and others will become of bearing age in 1945 and 1946. This planting is designed to give growers first-hand knowledge of the newer varieties and an opportunity to compare them with standard sorts now grown.

Notes are being taken on blossoming dates, season, insect and disease resistance, and fruit quality. As production increases, tests will be conducted to determine the adaptability of the more desirable varieties to shipping and processing.

FLOWERS AND NURSERY

Plant Introductions Show Promise

During the past season many species of plants have been added to the test nursery. While not necessarily new to the horticultural trade in some areas, most of the plants are new to North Carolina nurserymen.

The western sand cherry, *Prunus besseyi*, has made excellent growth and is very attractive. Although occurring in alkaline soils and in semi-arid regions, it seems at home in the light, acid soils of Eastern Carolina and in a high rainfall belt. As an ornamental it is likely to serve best as a hedge or background plant for its maximum height here is about four

feet. The fruit is very palatable and yields a good crop annually. It is hardy to late freezes and very disease resistant.

A natural seedling of the Carolina wild peach has also attracted attention. The seedlings are rigidly upright with a strong central leader. The flowers are deep pink and last several days longer than do most peach flowers. The fruits, although small, are highly colored and are good for pickling. The vigor of the tree makes it of interest as an understock, but its immediate value is as an ornamental. The upright character seems fixed as it comes consistently true from seed. Work is being continued with it.

An evergreen sumac, *Rhus virens*, from the limestone hills of south central Texas and Mexico has been showing to good advantage as an ornamental. It is a low growing plant of beautiful color. The small red berries contrasted against the deep green foliage are not unlike the effect of a dwarf holly. This plant is quite disease resistant and requires little or no pruning. If the species holds consistently through the 1945 season, state growers will be urged to add it to their lists.

Ornamentals Respond to Fall Fertilization

Many ornamentals used in North Carolina are difficult to maintain in landscape plantings and as nursery subjects mainly because of nutritional disorders. In the spring of 1944 tests were set up to determine the effects

of commercial fertilizers applied to ornamentals at different seasons of the year and in varying amounts.

No results can be reported at this time but some very interesting observations have been made. On broad-leaf evergreens the best growth response has been obtained on late summer and fall application of fertilizer. Also, plants which ordinarily color in early winter failed to do so but retained vigorous green foliage into mid-winter as a result of fall fertilization. On roses there was less disease and "die-back" from late summer fertilization, although no apparent increase in floral production was noted.

In general, all the plants receiving their allotment in late summer or fall were superior to those fertilized in the spring or to those obtaining small amounts at intervals through the growing season.

LIVESTOCK AND POULTRY



BEEF CATTLE

Winter Condition of Beef Cows Affects Future Calf Crops

Three trials comparing the wintering of beef cows on forest range supplemented with two, four and six pounds of either cottonseed meal or soybean oil meal per head daily have been completed at the Hofmann Forest. Each group contained from 27 to 32 grade cows, principally of Hereford breeding, which were bred to calve in February, March and April. The supplement was supplied from approximately January 1 to May 1, and a rather complete mineral mixture was available to the cattle at all times. In the third trial, the cows used in the preceding trial were kept in

their same groups so as to study the accumulative effects of feeding winter concentrates at different levels. After the close of the wintering periods the groups were grazed together on another forest range to study the effects of the previous wintering on summer gains.

The weight changes of dry and nursing cows during the wintering period in all three trials were in proportion to the amount of supplement furnished. The groups receiving the most supplement in all cases either lost less weight or gained more. The greatest drop in weight of the nursing cows occurred at calving. Before this time the changes in weight were similar to those of the dry cows, which

FIG. 46. COWS WINTERED ON FOREST RANGE AND COTTONSEED MEAL.

were slight. All cows were in the poorest condition in March when the forage was scarce and of lowest quality, but most of them began gaining in April when new forage appeared.

On the average, gains during the grazing season were inversely related to weight changes during the winter, i.e., those groups that lost more or gained less in the winter gained the most weight during the grazing season. The calf gains for both winter and summer were only slightly greater in the groups that received the most supplement.

In the third trial the cows in all three groups wintered satisfactorily (Fig. 46), calved without difficulty, but the percentage calf crop dropped off from what it had been the two previous years. The drop was considerably greater in the groups fed two pounds and four pounds than it was in the group receiving six pounds and must have been due to the differences in amount of concentrates given the previous winter. Even though the cows that had been wintered on the lower amounts of supplements were, because of more rapid summer gains, in nearly as good condition at the close of the preceding grazing season as those in the six-pound group, many of them apparently were too poor at breeding time to conceive. In the three groups combined there were 46 living calves which, instead of being rather evenly distributed between the groups, as was the case the first two years, were distributed 10 in the two-pound group, 16 in the four-pound group, and 20 in the six-pound group.

Most of the differences in gains of the group of cows during the winter were offset the following summer by the greater gains of the cows that had received the least supplement the preceding winter. However, if the cows are wintered too poorly, the death losses will be greater and the follow-

ing calf crops may be materially reduced due to the cows being too poor to breed or conceive during the normal breeding season. A practical cattleman can guard against this by frequent inspections of the available forage in his range and the condition of his cattle. He can then increase the amount of protein concentrate whenever it is needed in order to maintain the proper condition in his cattle.

Beef Cattle Convert Roughage into Meat

The third feeding trial comparing cottonseed oil meal with soybean oil meal as protein supplements for fattening yearling steers was completed at the Blackland Station in Washington County on March 9, 1944. While the direct comparison was between these two southern-grown oil meals, much additional information was obtained.

For the three trials an average of approximately 280 pounds gain was produced per steer during a 130-day period, and with the exception of corn, none of the feeds consumed was suitable for human consumption. The corn was well-utilized, too, for with the other feeds in the ration figured at current market prices, the corn fed returned from \$2.18 to \$3.04 per bushel.

During the finishing period the steers were full-fed shelled corn and shredded corn stover, and received 5 pounds of soybean hay per head daily. In addition, one group was given 2 pounds of cottonseed meal (41 per cent protein) and the other group 2 pounds of soybean oil meal (45 per cent protein) per head daily. They were started in the fall at an average weight of 657 pounds and were fed to a finish that would grade high good.

The soybean oil meal group produced greater gains, required less feed per unit of gain, graded slightly

higher and made cheaper gains than the cottonseed meal group, however, none of these differences was large. Over 40 pounds of pork was produced behind each steer, chiefly on feed that would have been wasted.

These steers were bred and raised on the Blackland Station and were grazed until put in the feed lots, chiefly on reeds, field gleanings and winter pasture with minimum amounts of harvested roughages and concentrates. Although they were worth \$9, \$11 and \$10.50 per cwt. at the beginning of the first, second and third feeding trials, they had cost only \$5, \$5.50 and \$6 per cwt., respectively.

The first 657 pounds of gain per head, therefore, had been produced almost entirely on food unsuited for human consumption, much of which would have been wasted otherwise. When the entire enterprise, including raising the calf, growing the stocker, and fattening in the feed lots, is considered, the total profit per steer was over \$45 per head.

The steers in the feeding trial at the Blackland Station were grown and fattened to an average weight of nearly 1,000 pounds with the consumption of less than one ton of feeds suitable for human consumption. The cows, calves and stockers used in the beef cattle program were carried on reeds on cut-over timberland from 7 to 12 months each year.

Creep Feeding Calves on Reed Pasture

Creep feeding beef calves on reed pastures was found to be unprofitable in four trials completed at the Blackland Station on October 26, 1944.

Four groups each of ten cows and ten nursing calves were used in the trials. Groups I and IV received no supplement. Calves in Group II were creep fed (4 parts corn and 1 part

cottonseed oil meal throughout the grazing period), but those in Group III were not creep fed until about August 1. Group IV was moved to lespedeza pasture about August 1. The reed pastures were grazed at the rate of four acres for each cow and calf from about May 10 to November 15 and the groups were rotated between the pastures at each 28-day weigh period.

Throughout the four trials the cows and calves made very satisfactory gains on reeds, the cows showing an average daily gain of a little over $\frac{1}{2}$ pound and their calves approximately $1\frac{1}{2}$ pounds. The greatest gains, especially for the cows, were made the first two months of the grazing period.

Creep feeding increased the rate of calf gains slightly, especially after about August 1, but the increase was not great enough to offset the cost of concentrates and labor involved. It should be pointed out here, however, that the grade Hereford cows used were from one-quarter to one-half native breeding and good milkers, and that the reed pastures were luxuriant. If cows that were poor milkers were grazed on pastures that provided less nutritious forage, creep feeding would probably have shown up more favorably.

Moving to lespedeza pasture about August 1 increased the comparative rate of gain for the remainder of the grazing season. The cows and calves in this group (Group IV) made the greatest gains for the season of any of the groups, the cows showing an average increased daily gain of $\frac{1}{10}$ pound and their calves $\frac{2}{10}$ pound. The calves from this group and the creep fed groups were in good slaughter condition at weaning at the close of the trials. Lespedeza pasture when used in this way fits in well with reed and other native woods pasture.

No Advantage to Rotational Grazing On Reeds

In four trials completed on November 22, 1944, at the Blackland Station, rotational grazing of beef cattle on reed pasture showed no advantage over continuous grazing.

Continuous grazing was compared with changing to ungrazed pastures on approximately August 1, and with rotating between two pastures every 28-day weigh period until the close of the grazing season. The pastures were grazed at the rate of three acres per yearling from about May 10 to November 15. Six groups of ten steers or heifers each were used in all trials.

The average daily gains for the four trials were slightly under one pound, but the differences in gains between the groups were not significant. These gains were somewhat lower than for cows or nursing calves grazed at the same time and rate on similar pastures. The results of this experiment show that livestockmen would not be justified in the extra expense of fencing and management necessary to provide rotational grazing in reeds during the growing season. Previous tests at this Station, though, brought out the necessity of rotating between summer and winter reed ranges.

DAIRYING

Piedmont Dairy Research Farm

The Piedmont Dairy Research Farm is used in a study of pasture building, roughage production, dairy farm rotations, dairy farming as a family enterprise (Fig. 47), erosion control (Fig. 48), and a number of closely related studies. It may be considered a pilot project to try out under actual dairy farm conditions, practices derived from field-plot projects.

All feed required for the dairy herd and other livestock is raised on the farm with the exception of cottonseed meal.

A rotation consisting of corn, small grains, and legumes and adequate fertilization was practiced. The legumes consisted largely of alfalfa, lespedeza, and red clover.

The twelve legumes that are being used on this dairy farm are:

1. Alfalfa
2. Lespedeza
3. Red clover
4. Kudzu
5. Locusts
6. White clover

7. Sweet clover
8. Soybeans
9. Vetch
10. Austrian peas
11. Crimson clover
12. Lespedeza sericia

These legumes are used for hay, silage, and grazing (Fig. 49). They are also used for soil improvement and erosion control.

More Care Needed in Production of Butter

Butter manufactured in North Carolina has been analyzed for moisture, fat, salt, and curd content, flavor, sediment, mold mycelia, and mold and yeast content. The results indicate that much improvement can be made in its composition and flavor. Improvement in composition would result in greater savings to the creamery. Better flavor would mean not only a greater demand for North Carolina butter now, but also in the future when competition will be keener.

The flavor of the butter can be

improved by exercising more care in the production and handling of the cream and butter. The composition of butter can be controlled by more rigid manufacturing and testing procedures.

Sweet Potato Vines Make Good Silage

Three years data at this Station indicate that sweet potato silage is equal to corn silage.

The average daily milk production per cow in the three feeding trials was 29.92 pounds for the sweet potato silage cows and 28.87 pounds for corn silage cows.

Normal Body Temperature for Cows Depend on Atmospheric Temperature

The normal temperature for dairy cows may vary within wide limits. Although it depends largely on atmospheric temperature, some cows consistently have a higher temperature than others.



FIG. 48. KUDZU—JULY 1ST—AFTER BEING DISKED MARCH 15 AS SHOWN ABOVE. THIS PRACTICE AIDS IN CONTROLLING WEEDS, BRIARS, AND SPROUTS, ENABLING FERTILIZER TO BE WORKED INTO SOIL AND CAUSING BETTER ROOTING OF THE RUNNERS.

The average respiratory rate varied in 1942 from 35 on September 30, to 91 on July 19. The difference between cows was highly significant in both years and quite consistent from year to year.

Humidity appeared to be significant when atmospheric temperatures

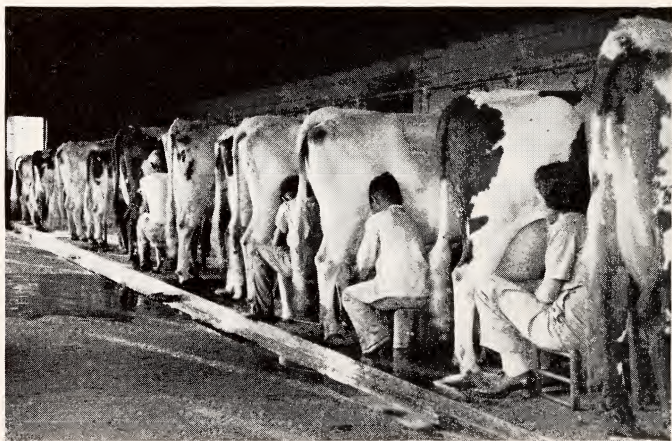


FIG. 47. DAIRY FARMING AT THE PIEDMONT DAIRY RESEARCH FARM IS A FAMILY ENTERPRISE. FATHER, MOTHER, THREE SONS MILKING.



FIG. 49. DAIRY HERD GRAZING ALFALFA. GRAZING ALFALFA STEPS UP PRODUCTION, RELIEVES PERMANENT PASTURE, AND WHEN JUDICIOUSLY DONE, IT DOES NOT DAMAGE THE STAND.
THIS IS A 7-YEAR STAND, THAT WILL BE PLOWED UNDER THE FOLLOWING SPRING.



FIG. 50. THIS HEIFER WAS FORCED TO OBTAIN TOO GREAT A PROPORTION OF THE ESSENTIAL NUTRIENTS FOR MAINTENANCE AND GROWTH FROM A POOR OVERGRAZED PERMANENT PASTURE.
NOTE: THE BOTTLEJAW—A SYMPTOM OF STOMACH WORM INFESTATION.
REPEATED CHECKING OF FECAL SAMPLES SHOWED FROM 1,000 TO 17,400 STOMACH WORM EGGS PER GRAM OF FECES VOIDED BY THE ANIMAL ABOVE.

were high, though it did not appear to be a major factor affecting body temperature.

Calves Resist Parasitic Infestation

Two pure-bred and two grade Ayrshire calves were drenched twice in tests with large populations of active stomach-worm larvae which were washed from spagnum moss on which they had been cultured. The drench was a normal salt solution containing the larvae.

Microscopic examination of the feces was made daily from ten days to three weeks. In all cases low egg counts resulted, the highest being 300 eggs per gram of feces. After each drench a large number of dead larvae were observed in the fecal material.

The calves drenched appeared to resist infestation by the culture of stomach worms that was used. This may be due to a weakness in the culture or to resistance of the animals. Clinically, a herd in which all animals show a heavy infestation is seldom seen. However, it is recognized that there is a large variation in resistance in animals to the stomach worm and seldom are all animals in a herd heavily parasitized.

The Holstein heifer (Fig 50) was located in a large herd and while the other heifers in the herd showed some evidence of *parasitism* the egg counts per gram of feces were much lower. Heifers in this condition should be handled carefully as any undue excitement may be fatal.

HOGS

Control of Rancidity in Cured Meat

Preliminary trials have shown that (1) nordihydroquaioretic acid (N.D. G.A.), (2), and (3) a mixture of isoascorbyl palmitate, soy lecithin and mixed tocopherols is effective in retarding rancidity or off-flavor development in cured pork.

All the antioxidants except gossypol have been approved for use in lard by the Meat Inspection Division of the Bureau of Animal Industry. N.D.G.A. is obtained from creosote bush, while the other antioxidants are obtained from various vegetable oils.

Keeping light from reaching the meat and using hickory smoke were also found to be very effective in retarding rancidity development both when used along and in connection with these antioxidants.

Feed No Soybeans in Latter Part of Fattening Period

Investigations carried on during the

past two years have helped much in explaining the mechanism of producing firm pork carcasses from pigs fed soybeans. The technique used involved the marking of the soybean oil that was fed pigs during various weight periods with a red fat-soluble dye.

Pigs fed the dye at 50 to 100 pounds had only 30 per cent as much dye in their body fat as pigs fed the same amount of dye at 150 to 200 pounds. Likewise, pigs fed the dye at 100 to 150 pounds had but 52 per cent as much dye in their body fat as the pigs fed at 150 to 200 pounds.

This explains recommendations made by this Station as to the necessity of taking pigs off soybeans or other oily feeds at approximately 100 pounds to firm the carcasses by feeding rations consisting principally of cereal grains and cottonseed meal. This is true since only a relatively small amount of the fat that is deposited in the early fattening stages

will remain there when the hog reaches slaughter weight.

Likewise, the nature of the fat in the carcass of the finished hog is largely dependent upon the type of feed fed in the latter part of the fattening period. If the feed has a considerable amount of oil, as soybeans, the fat will be soft and may even be oily. If the fattening feed has no soybeans or consists primarily of grains, it will generally be hard and the meat from the hog will bring a higher price on the market.

Corn-Soybean-Mineral Mixture Not Improved by Supplement

Twenty-four 33-pound pigs and twenty-four 38-pound pigs were fed in duplicate trials to study the effect of 0, 5, 10 and 15 per cent ground soybean hay when added to a grain mixture composed of ground yellow corn (53.5 to 68.5 per cent) and ground soybeans (20 to 30 per cent). (Fig. 51.) Those pigs that were fed 20 per cent soybeans also received 5 per cent cot-

tonseed meal and 5 per cent tankage, so that 12 pigs in each trial were fed additional protein to that present in the corn, soybeans and soybean hay. Each ration also contained 1.5 per cent mineral mixture.

All pigs were fed, in groups of three, in pens that were floored with concrete so that none of the pigs were allowed off concrete floors during the experiment.

A summary of the results from both trials show that there was good utilization of feed by all groups of pigs and that the additional 10 per cent of ground soybeans was just as efficient as 5 per cent tankage and 5 per cent cottonseed meal, since the pigs that were fed 30 per cent soybeans produced 100 pounds of gain for an average of 330 pounds of feed, while those that received 20 per cent soybeans and 5 per cent tankage and 5 per cent cottonseed meal consumed an average of 334 pounds of feed for each 100 pounds of gain produced. The average gains for the pigs from both methods of feeding were approximately 15 per



FIG. 51. SOWS GRAZING ON SOYBEANS.

cent less than would have been expected for pigs on a standard grain ration, but the pigs that were fed the additional protein feeds gained an average of 10 pounds more than the other group.

The addition of ground soybean hay to the corn-soybean rations was a definite disadvantage in that gains were depressed and feed consumption per unit of gain was increased. The 12 pigs that received no hay gained at the rate of 1.21 pounds per pig daily and consumed 323 pounds of feed for each 100 pounds of gain, while the 12

pigs in each of the groups that were fed 5, 10 and 15 per cent ground soybean hay made an average daily gain of 1.08, 1.10 and 1.04 pounds and consumed 336, 332 and 340 pounds of feed per cwt. gain, respectively.

It is obvious from the results of these two feeding trials that when 35-pound pigs are fed to slaughter weights (average, 180 to 198 pounds) that a corn-soybean-mineral ration is not improved by the addition of either tankage and cottonseed meal or ground soybean hay.

SHEEP

Soybean Hay and Beans for Wintering Ewes

The sixth and final wintering test on soybean hay and beans for wintering ewes was completed at the Animal Husbandry Farm, Raleigh, on April 18, 1944, and the results show that both are good sheep feed. However, the mature hay and soybeans may occasionally cause trouble when fed to ewes that are heavy with lamb or nursing.

In these tests soybean hay cut in the bloom stage was compared with similar hay that was cut after the beans had matured. Hay cut at both stages of maturity was supplemented with shelled soybeans, soybean oil or cystine. When hay alone was fed, it was provided at the rate of four pounds per ewe daily. In the supplemented groups, one pound of soybeans or 0.2 pound of soybean oil was used to replace one pound of hay, and cystine was fed at the rate of 1.25 grams per ewe daily. After lambing, all ewes were fed a grain mixture in addition to their regular ration. The trials consisted of 6 to 10 Hampshire ewes in each group and were conducted from about December 1 to the

latter part of April. The first trials were conducted in the dry lot but in the later ones the groups were grazed together on barley and rye grass pasture whenever forage was available.

All groups wintered satisfactorily and weaned a normal lamb crop (Fig. 52). The ewes receiving shelled soybeans gained more before lambing and were in better condition at shearing time than those in the other groups. The immature hay groups were slightly superior to the mature hay groups in this respect. The replacing of part of the hay with soybean oil or the addition of cystine had no material effect. The lambs gained well in all groups.

Throughout these six trials a small percentage of the ewes and lambs in the groups receiving either soybeans or mature soybean hay (which contained mature soybeans) developed abnormal conditions. These conditions were more frequent and severe when winter grazing was provided and the symptoms they produced were stiffness of hind legs, inflamed udders and difficult lambing in the ewes, and stiffness and spasms in the lambs.



FIG. 52. EWES AND LAMBS ON RYE GRASS PASTURE AT CENTRAL STATION DURING SOYBEAN TEST.

Development of a Breed of Sheep Adapted to North Carolina

In an experiment at the Central Experiment Station, crossbred lambs out of Hampshire ewes bred to a Dorset ram and out of Dorset ewes bred to a Hampshire ram were dropped in the spring of 1944. This was the first step in an attempt to develop a breed of sheep that will produce late December and early January lambs with greater consistency than mutton breeds other than the Dorset.

Nineteen of these crossbred lambs had an average weight of 71.5 pounds at 120 days of age. Grade and purebred Hampshire lambs dropped at about the same time and running with the crossbred averaged 65 pounds at

the same age. One more pair of twins among the crossbreds than among the Hampshires put them at slight disadvantage in being compared to the Hampshires. However, the Hampshires were dropped four days later on the average than the crossbreds, which, no doubt, was a disadvantage to the Hampshire since the pasture became poorer as the season progressed.

As is the case with most projects concerned with the improvement of livestock through breeding, it will be several years before the success of the undertaking can be evaluated, but results to this point are entirely satisfactory. The crossbreds grew well and have good body type. The first matings involving them will be made in the summer of 1945.

TURKEYS AND POULTRY

Better Performance of Turkey Hens

Economical production of turkey eggs for hatching purposes depends on early maturity, absence of pauses of six or more days, and intensity or

rate of laying. Improvement in all three of these traits was shown by turkey hens hatched in 1943 and tested as to performance during 1943-44.

The hens of 1943 began laying at

an average of 253 days as compared with 314 days for young hens of the previous year. This reduction in days to maturity may have resulted to a small extent from breeding, but was largely due to the use of morning lights, beginning around December 1. A reduction in broodiness was more likely the result of breeding with a decrease from 13.4 to 10.6 days per hen in this trait for the first three months of laying, and in time lost by other pauses from 5.9 to 2.8 days. The rate of laying increased from 67.7 to 70.2 per cent and the average number of eggs laid for the first three months of laying went from 49 in 1942 to 54.5 in 1943.

The turkeys hatched in 1944 were measured and weighed between five and six months of age, and breeders for the 1945 matings were selected from families having good records for both production and meat qualities.

Turkey Mortality Highest First Two Weeks

A study of two years' records at the Station Turkey Plant shows that 46 per cent of all mortality occurred during the first 14 days after hatch and that mortality from blackhead had its highest rate between the 14th and 16th week after hatch. Data on mortality in relation to time of hatch also indicate that the later the time of hatch, the greater the percentage of mortality that may be expected.

Blackhead Chief Cause of Adult Mortality in Turkeys

A summary of the causes of mortality in young hens (first year) for the past three years in the Station flock shows blackhead responsible for 32.2 per cent of the total mortality. Crop disorders caused the death of 18.8 per cent and other major causes were mycosis, tumors, and pathological conditions of the reproductive system.

Average Results for Well-Managed Turkey Flock

During the 1944 season in the Station flock of 118 young hens (mass-mated) the largest number of poults secured from one hen was 59 and the average was 26. Eighty-three and two-tenths per cent fertility and 82.1 per cent hatchability of fertile eggs were secured. As these results were secured under mass-mated conditions, they should approximate what the producer of hatching eggs might expect if good stock is given normal management.

Pullorum Disease in Turkeys

The major problem in the control of pullorum disease in turkeys lies in the detection and removal of infected breeding stock through blood tests, but there is still some question as to the efficiency of these tests to detect the infected birds.

To date, an intensive study has been carried out on 12 birds that were artificially infected with the pullorum germ. After repeated blood-tests these birds were finally killed and the tissues examined for the presence of the germ.

Both the rapid and tube test detected the birds that became infected and were carriers of the disease, but more turkeys, especially naturally infected birds, will be studied to evaluate these blood-tests better.

Feces and eggs from these birds were also tested to determine if infected turkeys voided the pullorum germ in their feces and if they laid infected eggs. In a total of 44 fecal cultures made from the voidings of eight infected birds, the pullorum germ was recovered in only one instance, thus indicating the scarcity of the organism in the droppings. Of the 22 eggs produced by the four infected laying turkeys, only three eggs, all

from the same two birds, contained the germ, and a later autopsy confirmed the presence of the pullorum germ in the ovaries of these birds. Egg infection, even though the percentage of infection is very small, is the initial source of infection in poults. One infected poult hatched in a modern forced draft incubator can infect a large percentage of poults which were free from the disease at the time of hatch.

Similar studies were made on turkeys that were inoculated with the pullorum germ when they were one day old. Blood tests were conducted on ten of the poults which survived the infection. From three to five months after they were inoculated, these birds were killed and their tissues examined for the presence of the pullorum germ.

In general, the tube test was proved more efficient than the rapid test in detecting infection in young birds. However, in one case neither test detected a bird found by bacteriological examination to be infected.

Feces from six of the above inoculated poults were examined over a period of two months, beginning 13 days after inoculation. The pullorum germ was recovered from the feces of each bird, but four times was the most it was recovered from any one bird. On the other hand, the germ was voided in the droppings for at least seven weeks after the poults were inoculated.

Natural Riboflavin Can Be Replaced By The Synthetic Type

Because of shortages of natural sources of riboflavin, chiefly milk products, tests were carried out to determine if a synthetic product, crystalline riboflavin (vitamin G), could successfully replace the natural product in poultry feed.

Mash formulas were developed for testing in which the control mash contained the natural sources of riboflavin and the two test mashes contained different levels of crystalline riboflavin with all three meeting the optimum standards for breeding birds from a biological standpoint. In addition, a grain mixture of corn and wheat was fed as a supplement, and housing and management of the birds were equalized as far as possible.

Rhode Island Red pullets were used in the test with trios of sisters used so as to control hereditary factors as far as possible. Twenty-five birds were put in each pen, kept under test for nine months of lay, and trapnested daily.

Study of the data collected does not show that the diets used resulted in different rates of production, as no significant differences were shown by the three groups in weights of eggs, body weights of the layers, riboflavin content of the eggs laid, or riboflavin content of the tissues of the layers.

More Eggs from Crossbred Layers

Crossbred pullets laid an average of 29 more eggs than did related purebreds in a test extending from the fall of 1943 to August 1, 1944. In addition, the crossbreds were superior in livability both on range and in the laying house, and except for a slight excess of broodiness, they were superior to the related purebreds for every factor measured.

The same Barred Rock sire was used to produce the purebred Barred Rocks, the Rock-Reds, and the Rock-Leghorns. The same Rhode Island Red male sired the purebred Reds, the Red-Rocks, and the Red-Leghorns. Likewise, a single White Leghorn male sired the purebred Leghorns and the Leghorn-Reds. The crossbred daughters of every sire were better than the purebred daughters, and conversely,

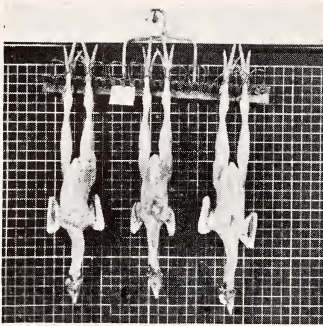


FIG. 53. ROCK-N. H. CROSSBREDS AT 12 WEEKS OF AGE WERE HEAVIER AND OF HIGHER GRADE THAN PURE-BRED ROCKS OR NEW HAMPSHIRE.

the crossbred daughters of every group of dams were superior to the purebred daughters.

On August 1, 1944, it was necessary to dispose of most of the pullets to make room for the new ones coming into production. To that date the average production based on the original number of pullets housed was 126 eggs for purebreds and 155 for crossbreds. This superiority of $2\frac{1}{2}$ dozen eggs per bird was equivalent to an increased profit of around seventy-five cents for each layer.

Thirteen of the best purebreds and 41 of the crossbreds were kept for a complete laying year, and the record shows that six of the crossbreds laid more than 300 eggs each, while the best purebred laid 260 eggs.

Faster Growth by Crossbred Broilers

Experiments conducted in 1944 have demonstrated again that the average performance of parent breeds was exceeded by their crossbreds. This



FIG. 54. A GROUP OF 14 ROCK AND 12 RED PULLETS THAT LAID 300 OR MORE EGGS IN 365 DAYS. THESE BIRDS ARE FROM FAMILY TESTS AT THE CENTRAL PLANT IN THE 1943-44 LAYING YEAR.

superiority was also shown in livability, rate of feathering, and appearance of the dressed birds at 12 weeks of age. At a dressing plant an experienced grader ranked the first hatch of broilers in the order of Rock-New Hampshire, New Hampshire-Rock, Rocks, and New Hampshires. Figure 53 shows a group of the Rock-New Hampshires.

These results are in agreement with those previously reported and demonstrate that crossbreds may be expected to live better, grow more rapidly, and become fully feathered earlier than related purebreds.

Superior Families of Reds and Rocks

Improvement in both livability and production has been made in the Rhode Island Reds at the Central Experiment Station at Raleigh and at the Lower Coastal Plain Station at Willard, and in the Barred Plymouth

Rocks at Raleigh. Four pen matings are made and around 300 pullets kept each year for each of the three groups.

For pullets hatched in 1943, the livability from two to twelve months of age of the Reds at Raleigh was 86 per cent. Both the Reds at Willard and the Rocks at Raleigh the percentage was 85.

In the Reds at Raleigh the average through the first six months of laying rose from 121 eggs per bird to 133. The Willard Reds showed an increase from 111 to 122, and the Raleigh Rocks from 94 to 120. Size of eggs was above standard in all three groups. In the families kept for a complete laying year, 12 Reds and 13 Rocks at Raleigh and two Reds at Willard laid more than 300 eggs. The highest performance was 331 by a Red and 335 by a Rock. Figure 54 shows the "300-egggers" at the Central Experiment Station.

NUTRITION

Riboflavin in Soybeans

Previous experience has shown that the analysis for riboflavin in soybeans by the rat-growth method yields higher and much more variable results than the photofluorometric method. If this difference between the two is real and not a result of the high experimental error due to differences in the individual rats, it is important to find which method gives more nearly the true value and the reasons for the failure of the two methods to give the same result.

As a step towards this end, it has been found that a complex experimental design (a lattice square), originally used for field varietal tests, can be applied to rat feeding experiments. When this design is used, corrections can be made for individual variation between rats. In this way, the experimental error can be reduced

appreciably. In addition, to get the same amount of replication with a simpler design, three times as many rats will have to be used. Thus, it is found that the lattice square technique gives equal or greater efficiency with fewer animals.

An assay for riboflavin in soybeans, using the lattice square, shows that the rat-growth method gives a definitely higher value than the chemical laboratory procedure. The experiment also shows that this is not due to a small amount of any of the common vitamins or other growth stimulants in soybeans which might be measured as riboflavin.

A careful check has shown an unsuspected source of error in the photofluorometric method, but, as yet, it has not been determined which procedure gives more nearly the true value for riboflavin in soybeans.

Cystine and Yeast Supplement Soybeans

The supplementation of raw soybeans in attaining good growth remains a feeding problem. Young pigs, white rats and chicks have been used for investigation of the problem. The Wisconsin Agricultural Experiment Station reported that various amounts of legume hay supplemented soybeans for the growth of pigs and the white rat.

This work has been repeated at this Station in a feeding experiment with the white rat, adding 5 and 10 per cent dried lespedeza clippings to a 10 per cent protein ground raw soybean ration. It has been definitely shown with the Tokio bean that dried lespedeza clippings did not aid growth but in the larger amount depressed growth, while 1 or 2 per cent of dried brewers yeast proved beneficial.

Likewise, graded amounts of cystine and dried brewers yeast definitely supplemented the raw soybeans for growth. The use of both these constituents was more effective at an optimum level of cystine than either one alone.

The supplemented ration of raw soybeans was not deficient in riboflavin for the growth of the white rat.

Protein, Calcium and Phosphorus Content of Three Varieties of Lespedeza

Korean, Kobe and Common lespedeza were grown on both fertilized and unfertilized plots to determine their carotene, nitrogen (protein), calcium, and phosphorus contents.

Samples were taken from each in July before blooming, in August when the Korean was in early bloom but before the others were in blossom, and again in September when all were blooming.

It was found that none of these constituents was affected by the fer-

tilization. The lespedeza made very little growth between the sampling dates because of extremely dry weather. It is probable that the lack of moisture prevented the plants on the fertilized plots from using their extra supply of nutrients, and in a more normal season there may be a difference in the nutritive value of lespedeza grown on fertilized and unfertilized land.

On an average, the Korean variety contained slightly more carotene, definitely more protein and phosphorus, and less calcium than the other two varieties. Both Common and Kobe were very similar in their composition.

The calcium content of all varieties fell off as the season advanced. While the protein and phosphorus were slightly less in August than in July, by mid-September they had increased almost to their July levels. This was probably due to the storage of protein and phosphorus in the maturing seeds.

Large Sweet Potatoes Richer in Vitamin C

The large size or jumbo Porto Rico sweet potatoes have been found to contain an average of almost 2 per cent more moisture and 6.5 mgs. more ascorbic acid or Vitamin C per 100 grams of dry solids than strings or roots smaller than the U. S. No. 2 grade.

The amount of carotene or provitamin A in these two sizes did not differ materially.

More Vitamins in Stem End Than in Root End of Yams

When Porto Rico sweet potatoes were cut crosswise into three approximately equal parts and the parts analyzed separately, it was found that the moisture content was higher in the middle than in either end. The center portion and the stem end contained about the same amount of vitamin C,

but this was definitely more than that in the root end. The carotene or provitamin A was greatest in the stem end, somewhat less in the center, and still less in the root end.

Collards Have High Nutritive Value

A study of nine varieties of collards has revealed that this vegetable is an excellent source of the three important vitamins: ascorbic acid (vitamin C), riboflavin (vitamin B₂), and carotene (pro-vitamin A).

Most striking perhaps was the ascorbic acid value which averaged 115 mg. per 100 grams (fresh basis) in October. This is at least twice the amount of this vitamin found in oranges. The highest vitamin C values were obtained from the Georgia, Louisiana Sweet, and North Carolina Short Stem varieties. The average riboflavin content (fresh basis) for the nine varieties was twice as great as that for milk on a comparable basis. The Green Glaze, Herring, Louisiana Sweet, and North Carolina Short Stem varieties had the highest riboflavin values. Collards analyzed in November had an average carotene value of 3.0 mg. per 100 grams on a fresh basis with Wyatt's cabbage, North Carolina Short Stem, Morris, and Wonder ranking highest.

Since collards are a popular winter garden crop, it was interesting to determine if these vitamins were lost as a result of frost. The varieties studied showed no loss in carotene when analyzed on November 16, after several sharp frosts. On a fresh basis, ascorbic acid decreased only from 115 mg. per 100 grams in October (before frost) to 108 mg. in November (after frost). Due to a slightly lower moisture value after frost, however, this represents a loss of 21 per cent when calculated on a dry weight basis. The average

riboflavin value was decreased only slightly as a result of frost.

Thus, it is evident that collards are an excellent source of carotene, ascorbic acid and riboflavin even after the crop has been subjected to severe frosts.

Varieties of Sweet Potato Differ Widely in Vitamin Content

In a study of 23 varieties or strains of sweet potatoes, the carotene (pro-vitamin A) results were particularly striking, demonstrating that whereas the red- or yellow-fleshed varieties or strains are remarkably good sources of vitamin A, the white-fleshed kinds provide only very small quantities of the vitamin.

Thus, Nancy Gold, Ranger, and 1 x 6-39-6 and 39-10 had carotene values of over 5.5 mg. per 100 grams on the fresh basis, while each of the following varieties or strains contained less than 1.0 mg.: Vineland Bush, Yellow Jersey, Big Stem Jersey, Red Jersey, Key West, Triumph, Southern Queen, and 22437. It is evident that breeding experiments with sweet potatoes looking toward the development of varieties or strains possessing high vitamin A value should prove fruitful. The carotene in five different strains of Porto Rico potatoes ranged from 2.3 to 4.4 mgs. per 100 grams and that in two strains of Nancy Hall was 1.9 and 2.0 mgs.

Differences in the ascorbic acid (vitamin C) contents of varieties of sweet potatoes are not as extreme as in the case of carotene. Nancy Gold, Nancy Hall, Vineland Bush, Yellow Jersey and 39-10 varieties contained over 25.3 mg. per 100 grams on a fresh basis. Remaining values ranged from 16.2 to 25.0 mg. per 100 grams. The average ascorbic acid value for all varieties studied was 23.1 mg. per 100 grams.

48,000 in 1941 to 70,000 in 1944, or an increase of 46 per cent. Pork production increased markedly: the sows to farrow increased from an average, 1935-39, of 109 for spring farrowing, and 93 for fall farrowing to 140 and 110 in 1944. Hens and pullets increased from 8,349,000 in 1941 to 12,985,000 in 1944, or an increase of 56 per cent.

It is obvious that after the war many changes in production will be necessary if heavy losses, similar to those suffered after the last war, are to be avoided. This does not mean a return to prewar levels, but it does mean a rational adjustment to meet anticipated price and cost changes.

For example, present tobacco acreage can be maintained profitably for a short time after the war, but tobacco farmers should be prepared to reduce tobacco acreage quickly if adverse conditions appear to justify such a course. Even with reduced tobacco acreage, farmers may have difficulty in maintaining a satisfactory net income. This means that growers should be alert to ways of increasing quality and of reducing production costs. This holds true not only for tobacco but also for all crops and livestock products.

Cotton production should be maintained at its present level of 850,000 acres until some more profitable enterprise becomes available. The farmers of the state have done a magnificent job in reducing the production of this crop and increasing its quality. In the postwar period additional attention must be given to producing that quality of cotton most needed by the domestic market.

Vegetable crops will have to be adjusted to domestic demands which may mean a marked decrease in acreage after the war. Growers of these crops should be on the lookout for ways of reducing production costs or growing

new substitute crops, and of improving markets and market facilities.

Livestock production will need adjusting. The major desirable changes in terms of 1943 production will be as follows:

Milk cows should be increased 25 per cent with a large portion of this increase being used for family cows. **Beef** cows should be reduced 5 per cent. More emphasis should be put on improved quality by better feeding, breeding, and management practices. **Sheep** are not at present of major importance in the state but should be increased about 15 per cent, with more emphasis on recommended production practices. The net production of **pork** should be increased about 4 per cent. However, this should be done with about 20 per cent less sows to farrow than in 1943. The wider adoption of recommended practices should increase the number of pigs saved and reduce the amount of feed required to produce a pound of pork. **Hens and pullets** should be increased 29 per cent. Proper distribution of these birds will improve the organization and balance of many farms within the state. **Commercial broiler** production should increase 27 per cent while the number of **turkeys** raised should be increased 54 per cent. Some increase in efficiency may be expected in all phases of poultry production.

Costs of Operating Farm Tractors And Equipment

A study of farm mechanization in the Northern Coastal Plains revealed that the average cost of operating 125 tractors was 54 cents an hour and that costs varied with the size of the tractor, type of work done, and amount of annual use (Fig. 56).

The average cost per hour of operating small tractors was 47 cents; medium, 54 cents; and large tractors,

67 cents; tractors doing light work was 48 cents an hour as compared to 60 cents for heavy work.

The overhead or fixed costs of operating tractors varied with the amount of annual use, while the "out of pocket" costs for fuel, motor oil, etc., remained approximately constant regardless of the extent of use. Based on medium tractors, the average cost per hour of operation was 61 cents when the annual use was less than 800 hours and only 50 cents when the annual use was over 1,000 hours.

The cost of operating tractor equipment other than combines and peanut pickers was \$1.83 per 10-hour day or 65 cents per acre in crops. Depreciation amounted to approximately 50 per cent of the total cost; and repairs, 38 per cent. The total cost of operating machinery increased with

the size of farm but the cost per acre decreased.

The average annual cost of operating 49 six-foot combines in the Northern Coastal Plains was \$178. The average machine harvested 144 acres of small grains, soybeans, and lespedeza at a cost of \$1.24 per acre. Depreciation, the largest item of cost, was 59 per cent of the total cost. Annual repairs were 30 per cent and interest was 11 per cent of the total cost.

The annual cost of operating 56 peanut pickers was \$116. Each machine picked, on the average, 124 acres of peanuts at a cost of 93 cents per acre. Repairs were the most important

¹ The illustrations appearing in this figure have been obtained from several sources. They are used here simply to indicate some of the activities of the farmer, the business aspects of which constitute the field of agricultural economics.



FIG. 56. THE COST PER HOUR OF OPERATING A TRACTOR DEPENDS UPON THE SIZE OF THE TRACTOR, TYPE OF WORK, AND NUMBER OF HOURS USED ANNUALLY. (COURTESY OF SOIL CONSERVATION SERVICE.)

item of cost, or 49 per cent of the total cost. Depreciation made up 38 per cent, and interest on investment, 13 per cent of the total cost.

Effects of Recommended Practices on Production

Yields of many crops and production of livestock could be increased as much as 50 to 100 per cent if farmers would use the practices recommended by the Experiment Station.

This fact has been revealed by a study in which specialists and research workers were asked to list the approved practices, or those they would recommend for each enterprise, their effects on production, the extent to which each was used in 1943, and the extent to which it might pay farmers to adopt each practice in the postwar period.¹ Rates of production based on the adoption of the practices were calculated and compared with rates of production obtained in 1943.

The least increase in yields, as a result of using better practices, is for the main cash crops on which the farmers are now doing a good job, and the greatest increase is for corn and forage crops. It is estimated that it would be profitable to increase the yield of tobacco only 21 per cent, while it would be profitable to increase the yield of corn 86 per cent, and the yield of hay 100 per cent. One factor in the increase in corn yields is the introduction of hybrid strains. In the case of hay, it is suggested that it would be profitable for at least one-fourth of the total hay acreage to be planted in alfalfa.

Expected increases for livestock are not as great as for crops. The estimated profitable increase in milk production per cow is 39 per cent, beef

per cow 18 per cent, and eggs per hen 27 per cent.

At the same time, by increasing yields according to these recommendations, it would be necessary to reduce acreage and livestock numbers to bring production in line with demand, which, in many cases, would make for a better balanced system of farming and a greater conservation of farm resources.

Poultry Marketing Facilities

In a study undertaken by the Agricultural Experiment Station in 1944 to determine the size of wholesale poultry marketing facilities in the state, preliminary results indicate that, on the whole, wholesale poultry dressing facilities are inadequate to serve the farmers of the state. There are about 20 wholesale dressing plants with a combined dressing capacity of approximately 40,681,000 pounds per year, as compared with over 70,000,000 pounds placed on the market for sale.

These plants are not ideally located from the producers' point of view. Almost 84 per cent of the total dressing capacity is situated in the Central section of the state, while 14 per cent is in the Western area, and only 2 per cent is to be found in the Eastern region. In contrast, approximately 41 per cent of the state's poultry is raised in the Eastern portion, 34 per cent in the Central portion, and 25 per cent in the Western portion of the state.

At present, most of the poultry produced in the Eastern section of the state finds its way to market via "pick-up" men. These people are professional truckers who tour the area buying poultry and eggs for sale, principally in northern markets. At the same time, dressing plants in the Central and Western sections of the state import birds from other states.

One of the most startling revela-

¹ The estimates of profitableness in the postwar period were made on certain assumptions regarding costs and prices. See N. C. State Report on Production Adjustments in Agriculture, pp. 1-9.

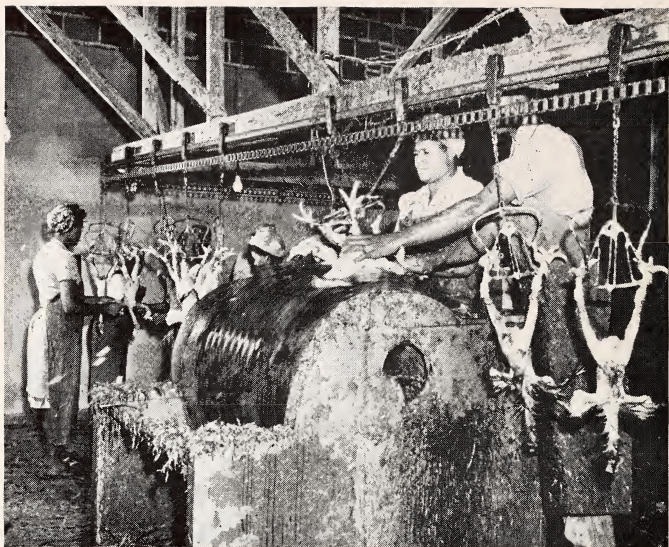


FIG. 57. A MODERN POULTRY DRESSING PLANT IN ACTION. NOTE PICKING MACHINE AND ENDLESS OVERHEAD CONVEYOR CHAIN. BIRDS ARE KILLED, SCALDED, PICKED AND DRESSED ON THE CONVEYOR CHAIN. THIS PLANT HAS AN ANNUAL CAPACITY OF OVER SIX MILLION POUNDS.

tions of the study was the difference in facilities and sanitation that exists among the dressing plants. The better plants have smoothly finished concrete floors, excellent drainage facilities, an adequate supply of steam (used mainly for cleaning), hot water and protection from flies. The live birds are kept separate from the rest of the plant. In plants of this type, the birds are suspended by their legs from shackles attached to a conveyor chain, by which the fowls are carried through a killing pen, a scalding vat, and a series of mechanical pickers. (Fig. 57.) They are next conveyed past a line of operators who remove pin feathers, after which the birds are drawn and placed in ice-filled vats to remove body heat. Following this

process, the chickens are graded prior to shipment in ice-packed containers.

In contrast to these modern plants, other establishments are indescribably filthy. Floors are made of wood, there is no drainage, steam is not available, hot water is supplied by a two-burner oil stove, and window and door screens are non-existent. Live birds are permitted to wander at random throughout the plant. At this type of plant the neck of the birds is severed or partially severed after which it is allowed to lie on the floor or is thrown into a barrel until dead. After it is dipped into a pot of hot water, feathers are removed, largely by hand, the fowl is drawn, and the entrails are deposited on the floor where live birds wander around in the debris. Body

heat is not removed by chilling, nor is the carcass packed in ice for delivery.

Over 40 per cent of the wholesale dressing plants were found to be unsanitary. The fact that this group

represents only approximately 17 per cent of the total dressing capacity indicates that the smaller establishments have less regard for sanitation than do the larger ones.

SOCIAL PROBLEMS

Neighborhood Leadership Movement

One of the recent important developments in rural life in North Carolina has been the growth of the neighborhood leader movement. In the rural areas of the state, groups of men and women have met in the past several years and selected from among their numbers outstanding people who in turn have cooperated with the North Carolina Extension Service in furthering the war effort on the home front.

Each leader is responsible for informing a specified number of families in his neighborhood concerning projects being undertaken in his county and for encouraging and making easier their participation in these projects. The chief emphasis to date has been upon activities directly connected with the war effort, such as the collections of scrap iron and the development of Victory gardens.

Because each county has particular problems, however, special county situations are also solved through the neighborhood leadership system. For example, in a western county, an acute shortage of manpower for harvesting was met by appealing to the neighborhood leaders for assistance in recruiting the needed labor.

The crisis of war has shown that leadership exists in abundance throughout the rural areas of the state, and that it is functioning most effectively. The work, purely voluntary in nature, being done by men and women leaders is outstanding. The neighborhood leadership system in North Carolina is attracting nation-

wide attention. Its potentialities are not limited to wartime conditions but hold promise of an effective neighborhood organization and functioning when peace returns.

Medical Care Services for Rural People

Medical science has made great progress, but the distribution of modern medical services has lagged behind. Rural people in particular are failing to get adequate medical care. Doctors do not wish to live in rural communities because of the lack of modern hospitals and because of the more attractive incomes and living conditions in the cities.

As a minimum standard, one doctor for each 1,000 people is needed, although the nation as a whole has one doctor for each 800 people. North Carolina in 1940 had one doctor for 1,554 people, and the rural areas had only one rural doctor for each 3,613 people.

A comparison shows that this shortage is getting worse. In 1914 the state had one rural doctor for each 1,678 rural people—relatively more than twice as many rural doctors as in 1940.

The hospital bed situation is correspondingly bad. Four or more general hospital beds per 1,000 people are needed and the state as a whole has only 2.4 beds per 1,000. Of the 8,475 general hospital beds in the state, 41.7 per cent are located in the six largest urban counties of the state. Thirty-four counties have no hospital beds

and an additional 31 counties have less than two beds per 1,000 people.

Poor health is not only an evil within itself but it leads to economic inefficiency, debt, loss of homes, loss of self respect, disintegration of family life, and to increased public expenditures for dependency.

Impact of the War on Farm Population

During 1943 the farms of North Carolina lost 65,400 people net by migration to towns and cities, to other states, and to the armed services, a rate of loss three times greater than that during the pre-war period.

Of the 65,400 net loss by migration, 12,200 went to other states; 27,800 went to towns and cities; and 25,400 went into the armed services. At the end of 1943, it is estimated that 73,700 North Carolina farm boys were in the armed services. By the end of 1944, possibly over 100,000 North Carolina farm youths were in the services. An additional 100,000 North Carolina farm people are probably working in war industries.

Due to these population losses, the total number of people on farms as of January 1, 1944, was approximately 1,548,700. By January 1, 1945, this number has probably decreased to less than 1,500,000. This estimate is based partly on the fact that the nation's farm population has decreased from 30 to 25 million since 1940 and on an expected continued migration from farms in North Carolina.

Population losses have been heaviest in the Mountain counties where cash crops are not so important and where great population surpluses prevailed before the war.

The farm population of the state would have declined much more had it not been for the great increase in births and the decrease in the death rate. In 1943 alone there were 45,600

births and only 12,600 deaths on the farms of the state. Thus, there was a natural increase on farms of 33,000 people. Birth rates were highest in the Coastal Plain.

Needless to say, after the war we may expect a heavy return migration to North Carolina farms, of both war veterans and ex-industrial workers. The farm population, within two years after the war will likely exceed 1,700,000 people, or 200,000 more than we have now. At the same time, the effective market demand for North Carolina agricultural commodities will be shrinking.

This prospect for a greater farm population and a smaller market calls for careful thinking and courageous planning for the future—at county, state and national levels. Full employment in agriculture, in industry, and in all other occupations is the minimum goal for which we should strive.

High Farm Production—Low Manpower

Farmers in North Carolina were faced at the beginning of 1944 with the greatest agricultural production goals in the history of the state. Farm laborers, on the other hand, were rapidly being called to the armed forces and others were moving to war industries. Farm machinery in desired and necessary quantity was not available. Other obstacles and problems were besetting the farmers. Amidst all these handicaps, prominent writers were boldly predicting a famine in our nation during the first two or three months of the year.

But at the same time, farmers were planning to increase production in 1944 by 6 per cent over 1943 levels. This was to be done with less manpower. Taking into account this increased production, farmers needed 110 per cent of available labor. That

is, for the state as a whole, the regular available labor failed by 10 per cent to meet the labor needs.

Farms of small acreages did not have a labor shortage. Farms with less than 16 war units on the average had enough manpower as a part of the regular labor force to meet production needs. Farm with 4-7.9 war units needed only 77 per cent of their available labor as compared with 128 per cent of available labor on farms with 64 or more war units.

Three out of every five farms had less labor than they needed. On farms with a labor shortage, the deficit was about 35 per cent or an average of

131 man-days. Farms with 64 or more war units had an average deficit of 768 man-days, or 3.2 man-years.

Looking at the labor situation, one sees that it becomes more acute from west to east. For example, two-thirds of the farms in the Tidewater had less labor than they needed as compared with 43 per cent in the Mountain area.

The situation in the state can be summarized as follows: The average farm in the state had 6.30 people, 3.32 agricultural workers, 1.54 man-equivalent workers, needed 1.69 man-equivalent workers, had 19.3 war units and 28.5 acres planted in crops.



SOIL CONSERVATION

Perennial Grasses Complicate Use of Surface Mulch

A partial stand of red top, a perennial grass, present on the site used for the new surface mulch experiment proved to be a definite obstacle when both corn and small grain were planted under surface mulch conditions.

In breaking the land for both of these crops with the subsurface sweep (Fig. 58), the grass turf settled back and continued to grow. (Fig. 59.) Fertilizer applied to the corn and wheat stimulated the grass to such an extent that both the stand and yield of these crops were greatly reduced.

These preliminary results, though secured by an accidental handicap, may be of considerable value since they indicate the difficulties to be expected with surface mulch methods when perennial grasses are present.

To correct this initial trouble the plots were turned in the early summer of 1944 to destroy the red top. Soybeans were then seeded to provide a substitute mulch for the wheat to follow in the fall, and for the corn in the spring of 1945. Wheat seeded through this soybean mulch, following subsurface breaking, came up to a good stand and has come through the winter in excellent shape—somewhat

FIG. 58. A SUB-SURFACE SWEEP ATTACHED TO AN ORDINARY PLOW FRAME. LAND CAN BE BROKEN AT ANY DESIRED DEPTH WITHOUT TURNING AND CROP RESIDUE IS LEFT ALMOST UNDISTURBED ON SURFACE. (COURTESY SOIL CONSERVATION SERVICE.)

better than on the turned plot. The use of annual forage crop residues for surface mulch seems to offer much promise.

No Benefit from Contour Furrows and Subsoiling

In the cooperative pasture studies at the Statesville Dairy Research Station, the contour furrowed and subsoiled plots were found to be no better than the areas without these mechanical treatments.

In fact, bare streaks in the grass cover still remain along the chisel cut made by the subsoiler as well as on the ridges formed when the contour furrows were plowed out. To this extent both subsoiling and contour furrows seem to be a disadvantage.



FIG. 59. A FIELD BROKEN WITH A SUB-SURFACE SWEEP. NOTICE SURFACE RESIDUE FROM PRECEDING SUMMER GROWTH OF COWPEAS, CRAB GRASS, AND A FEW WEEDS WHICH REMAINS ALMOST UNDISTURBED. THIS METHOD OF TILLAGE OFFERS CONSIDERABLE PROMISE AS AN EROSION CONTROL MEASURE. (COURTESY SOIL CONSERVATION SERVICE.)

FERTILIZERS

Study of Forms of Phosphate

One of the more promising of the newer forms of phosphate now being studied in the production of pasture and hay crops is fused rock phosphate, carrying around 30 per cent phosphoric acid and said to be a very economical material to produce.

In a pasture experiment in Haywood County, it has produced equally as well as triple superphosphate over a six-year period. This has been true not only for quantity, but also for the quality of the herbage, as measured by mineral and protein content.

In a greenhouse experiment with Sudan grass (Fig. 60) finely ground fused rock was equal to triple superphosphate but the coarser sizes of fused rock produced poorer growth at

the first cutting. This difference in favor of the finely ground product disappeared in the later cuttings of the same crop, indicating that the phosphate in the coarser particles does become available over a period of time. From this, one would expect that fineness of grinding of this material would only be important when used on a quick growing crop. When used on permanent pasture or perennial hay crops, where one application is expected to supply phosphorus over a considerable period of time, the coarse material might be entirely satisfactory.

This was borne out in a field experiment on alfalfa in which the coarser sizes were as good as the finely ground material for the first season. In this experiment fused rock

was slightly superior to triple superphosphate.

Calcium metaphosphate, a high analysis material (62 per cent phosphoric acid) has compared favorably with triple superphosphate in the production of permanent pasture over a six-year period. The quality of the herbage produced by this material has been equal to that produced with triple superphosphate.

Potassium metaphosphate is another new material that is being studied. As its name implies, it contains both potash and phosphate. It has been compared with superphosphate and muriate of potash in the production of permanent pasture for the past five years. Where adequate lime has been applied, it compares favorably with the standard sources. Since it contains practically no calcium, it is not as satisfactory on unlimed soils as are materials containing appreciable quantities of calcium. This does not appear

to be a serious objection to its use on permanent pastures, however, as good pastures must have adequate lime.

Forms of Nitrogen for Control of Granville Wilt

Beneficial results with uramon for the partial control of Granville wilt have been recently reported and further studies have shown that other nitrogen compounds may be equally effective.

The compounds used for comparison were ammonium nitrate, ammonium nitrite, ammonium acetate, and ammonium phosphate. They were applied at the rate of 400 pounds of nitrogen per acre to a disease infested soil of the Creedmoor type contained in terra cotta tanks. Tobacco was grown continuously for five years with rye and a mixture of hairy vetch and Austrian winter peas as winter cover crops. On July 30, half of the tobacco



FIG. 60. SUDAN GRASS GROWN WITH DIFFERENT SOURCES OF PHOSPHATE. TRIPLE SUPERPHOSPHATE (LEFT), 80-MESH FUSED ROCK (CENTER), AND 6-MESH FUSED ROCK (RIGHT).

had wilted following legumes and 70 per cent following rye. On the same date, with the chemicals, 6 and 30 per cent, respectively, had wilted. The ammonium nitrite-treated soil produced the most vigorous, and the ammonium phosphate-treated soil the least vigorous growing plants. The latter treatment also produced the least desirable quality leaves.

In another experiment with tomatoes, uramon applied at the rate of 1/6 pound per square yard (about 800 pounds per acre) substantially decreased Granville wilt of tomatoes.

Is the Chloride in Muriate of Potash Important?

It has long been known that potash in the form of muriate or the 20 per cent manure salt would increase crop yields on the muck soils of Eastern

North Carolina and the resulting effect has been considered indicative of a deficiency of the element potassium in these soils.

Experiments have also shown that copper sulfate would often produce marked improvement in crops on soils showing this evidence of potassium deficiency. Now it appears that the chloride which is combined with potassium may have contributed substantially to the efficiency of the potash fertilizer in connection with traces of copper by improving the state of oxidation in the soil.

In the practical application of this information it has been found possible to reduce the rate of application of potash when copper sulfate has been added to the fertilizer. And the results show a marked benefit to several crops on a wide range of soil types.

COOPERATION WITH THE UNITED STATES DEPARTMENT OF AGRICULTURE AND OTHER FEDERAL AGENCIES

BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY

Food Research Division

Regional Research Laboratories

BUREAU OF AGRICULTURAL ECONOMICS

Division of Agricultural Statistics

Division of Farm Management and Costs

BUREAU OF ANIMAL INDUSTRY

Animal Husbandry Division

BUREAU OF DAIRY INDUSTRY

Division of Dairy Cattle Breeding, Feeding, and Management

BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING

Division of Cereal Crops and Diseases

Division of Cotton and Other Fiber Crops and Diseases

Division of Forage Crops and Diseases

Division of Fruit and Vegetable Crops and Diseases

Division of Soils and Fertilizer Investigations

Division of Soil Survey

Division of Tobacco and Plant Nutrition

FOREST SERVICE

Division of Range Research

Appalachian Forest Experiment Station

SOIL CONSERVATION SERVICE

Conservation Experiment Stations Division

Nursery Division

TENNESSEE VALLEY AUTHORITY

Agricultural Relations Department

COOPERATION WITH INDUSTRIES

AMERICAN POTASH INSTITUTE

"Placement of Potash for Peanuts and Rate of Potash Studies on Three Soybean Varieties."

"Investigations on the Boron Content of the Major Soil Types and Its Availability to Plants, and the Response of Plants to Added Boron in the State of North Carolina."

THE BARRETT DIVISION, ALLIED CHEMICAL AND DYE CORPORATION

"Use of Liquid Forms of Nitrogen for Topdressing Purposes."

CROP PROTECTION INSTITUTE

"Peanut Disease Control and Cotton Seed Treatment Studies."

DOW CHEMICAL COMPANY

"Cotton and Soybean Seed Treatment Studies."

INTERNATIONAL MINERALS AND CHEMICAL CORPORATION

"Factors Affecting Maximum Response of Crops to Nitrogen."

THE NORTH CAROLINA ICE MANUFACTURING ASSOCIATION

"Effects on Nutritive Value of Packing Fresh Fruits and Vegetables in Cracked Ice."

ROHM AND HAAS COMPANY

"Peanut Disease Control Studies."

SWIFT AND COMPANY

"The Role of Cystine in Swine Rations."

TENNESSEE CORPORATION

"Peanut and Apple Disease Control Studies."

UNITED STATES RUBBER COMPANY

"Cotton and Soybean Seed Treatment Studies."

PUBLICATIONS

EXPERIMENT STATION BULLETINS

1. Bostian, C. H., and Dearstyne, R. S. *Breeding Can Lengthen the Life of Your Flock*. Research and Farming 2:4-6. April, 1944.
2. Bostian, C. H., and Dearstyne, R. S. *The Influence of Breeding on the Livability of Poultry*. N. C. Agr. Exp. Sta. Tech. Bul. 79. March, 1944.
3. Copley, T. L. *Contour Tillage Conserves Tobacco Soils*. Research and Farming 3:9. October, 1944.
4. Copley, T. L., Forrest, Luke A., Augustine, Marshall T., and Lutz, J. F. *Effect of Land Use and Season on Runoff and Soil Loss*. N. C. Agr. Exp. Sta. Bul. 347. December, 1944.
5. Cummings, R. W. *Lime—the Foundation for Building Soils*. Research and Farming 2:9-10. January, 1944.
6. Dearstyne, R. S. *Breeding Poultry for Superior Performance*. Research and Farming 2:6. January, 1944.
7. Dearstyne, R. S., Peterson, W. J., and Nesbit, W. B. *Sweet Potato Flour in Turkey Starting Mash*. Research and Farming 3:6. October, 1944.
8. Ellis, D. E. *Reduce Seed Costs for Lettuce Plant Beds*. Research and Farming 3:3-4. October, 1944.
9. Foster, J. E. *More Beef from Less Foods Suitable for Human Use*. Research and Farming 2:4-5. January, 1944.
10. Fulton, B. B. *Earworms and Shatterworms*. Research and Farming 2:11. January, 1944.
11. Greene, R. E. L. *Costs of Raising Dairy Heifers*. Research and Farming 3:5. October, 1944.
12. Greene, R. E. L. *The Dairy Farm—Its Organization and Cost*. N. C. Agr. Exp. Sta. Bul. 345. June, 1944.
13. Halverson, J. O., and Sherwood, F. W. *Increasing the Feed Value of Pastures*. Research and Farming 2:7. January, 1944.
14. Hamilton, C. Horace. *Less Manpower—More Production*. Research and Farming 2:11. April, 1944.
15. Hamilton, C. Horace, Holloway, Mary E., and Cole, Margaret M. *Rural North Carolina Needs Doctors*. Research and Farming 3:2-3. October, 1944.
16. Hendricks, Walter A. *Untangling Figures in the Statistical Laboratory*. Research and Farming 3:10. October, 1944.
17. James, H. Brooks, and Barlow, F. D., Jr. *Farm Mechanization—Power Costs and Production Requirements in the Northern Coastal Plains*. N. C. Agr. Exp. Sta. Bul. 348. December, 1944.
18. Lange, N. Gunnar, and Kenyon, B. W., Jr. *The Cost of Production Credit*. N. C. Agr. Exp. Sta. Tech. Bul. 80. September, 1944.

19. Lutz, J. F., and Hargrove, B. D. *Soil Movement as Affected by Slope, Discharge, Depth and Velocity of Water*. N. C. Agr. Exp. Sta. Tech. Bul. 78. January, 1944.
20. Lutz, J. F., and Moss, E. G. *Liming Tobacco Soils*. Research and Farming 2:10. April, 1944.
21. McLean, L. G. *Developing N. C. Plant Resources*. Research and Farming 2:3. April, 1944.
22. Mayo, S. C. *Making the Most Use of Farm Labor*. Research and Farming 2:8. January, 1944.
23. Mayo, S. C., Greene, R. E. L., Hamilton, C. Horace, and Forster, G. W. *1944 Farm Labor Problems—Farm Manpower Situation in North Carolina*. N. C. Agr. Exp. Sta. Bul. 344. May, 1944.
24. Moore, R. P., and Middleton, R. P. *Results of 1944 Variety Tests*. Research and Farming 3:4-5. October, 1944.
25. Moore, R. P., Rigney, J. A., Middleton, G. K., and Bennett, L. S. *Official Variety Tests 1943*. N. C. Agr. Exp. Sta. Bul. 343. May, 1944.
26. Morrow, E. B. *Fewer Berries from Renovated Beds*. Research and Farming 2:5-6. January, 1944.
27. Moss, E. G., and Teter, N. C. *Bright Leaf Tobacco Curing*. N. C. Agr. Exp. Sta. Bul. 346. June, 1944.
28. Nielson, L. W. *Looking to 1944's Potatoes*. Research and Farming 2:1-4. January, 1944.
29. Peterson, W. J. *The Nutritive Value of Eggs*. Research and Farming 3:12. October, 1944.
30. Peterson, W. J., Brady, D. E., and Shaw, A. O. *Get Your B-Vitamins from Meat*. Research and Farming 2:8. April, 1944.
31. Roberts, W. M., and Clevenger, W. L. *Better Creamery Butter*. Research and Farming 3:1. October, 1944.
32. Shaw, Luther. *Peanut Seed Treatment Pays*. Research and Farming 2:7-9. April, 1944.
33. Smith, Clyde F. *Controlling the Plum Curculio on Peaches*. Research and Farming 2:2-3. April, 1944.
34. Teter, N. C. *Notes on Drying Fruits and Vegetables*. Research and Farming 2:1. April, 1944.
35. Weaver, D. S. *Device for Helping Control Chinch Bugs*. Research and Farming 3:6. October, 1944.
36. Weaver, J. G. *Seeking a Tomato Resistant to Bacterial Wilt*. Research and Farming 3:11. October, 1944.
37. White, Harry A. *New Facts on Egg Marketing*. Research and Farming 2:9. April, 1944.
38. White, Harry A. *Turning the Spotlight on Egg Marketing*. Research and Farming 2:12. January, 1944.
39. Willis, L. G. *Lettuce and Nitrogen*. Research and Farming 2:7-8. April, 1944.
40. Willis, L. G. *Strawberries Need Borax*. Research and Farming 2:7. January, 1944.

EXTENSION CIRCULARS

1. Garriss, Howard R., and Ellis, D. E. *Disease Control in the Home Garden*. N. C. Ext. Circ. 272. February, 1944.

2. Gauger, H. C., and Dearstyne, R. S. *Common Parasites of Poultry*. N. C. Ext. Circ. 160. (Revised February, 1944.)
3. McLean, L. G. *Culinary Herbs in North Carolina*. N. C. Ext. Circ. 273. May, 1944.
4. Smith, Clyde F. *Peach Tree Borer Control in North Carolina*. N. C. Ext. Circ. 277. December, 1944.
5. Vestal, E. V., and Hostetler, E. H. *Raising Hogs in North Carolina*. N. C. Ext. Circ. 238. (Revised September, 1944.)

MISCELLANEOUS PUBLICATIONS

1. Barlow, F. D., Jr., and James, H. Brooks. *Mechanization in Relation to the Organization of Farms*. (Mimeographed.) 1944.
2. Brady, D. E. *Curing Important to Southern Lockers*. Quick Frozen Foods 6:53. 1944.
3. Brady, D. E. *Curing Plays A Big Role in North Carolina*. Quick Frozen Foods 6:55. 1944.
4. Brady, D. E. *The Frozen Food Locker Enterprise*. West. Frozen Foods 5:7. 1944.
5. Brady, D. E. *Locker Plant Offers Patrons Opportunity for Improved Living Standards and Savings*. Ice and Refrig. 106:211. 1944.
6. Brady, D. E. *Twelve Questions on Locker Curing*. Part I, Quick Frozen Foods 7:70-71. 1944. Part II, Quick Frozen Foods 7:74. 1944.
7. Brady, D. E., and Weaver, D. S. *So You Are Going to Build a Locker Plant*. The Locker Operator 6:16-40. 1944.
8. Brady, D. E., Peterson, W. J., and Shaw, A. O. *The Riboflavin Content of Beef*. National Cooperative Conservation of Nutritive Value of Foods. Progress Note No. IV. February, 1944.
9. Brady, D. E., Peterson, W. J., and Shaw, A. O. *The Riboflavin Content of Pork Loin Muscles and the Retention During Cooking*. National Cooperative Project on the Conservation of Nutritive Value of Foods. Progress Note No. III. (Mimeographed.) February, 1944.
10. Clayton, E. E., Gaines, J. G., Smith, T. E., Shaw, K. J., and Graham, T. W. *Control of Flue-Cured Tobacco Root Diseases by Crop Rotation*. USDA Farmers Bul. 1952. 1944.
11. Colwell, W. E. *Fertilizing Soybeans in North Carolina*. Better Crops with Plant Food. October, 1944.
12. Colwell, W. E. *Soil Fertility Problems with Soybeans*. N. C. Dept. of Agr. Bulletin on Analyses of Commercial Fertilizers. pp. 49-53. February, 1944.
13. Colwell, W. E., and Brady, N. C. *Soil Fertility Studies with Peanuts*. N. C. Dept. of Agr. Bulletin on Analyses of Commercial Fertilizers. pp. 54-67. February, 1944.
14. Copley, T. L., Forrest, Luke A., McCall, A. G., and Bell, F. G. *Investigations in Erosion Control and Reclamation of Eroded Land at the Central Piedmont Experiment Station, Statesville, N. C., 1930-40*. USDA Tech. Bul. 873. August, 1944.
15. Cummings, R. W. *The Importance of Potash in Maintaining Food Production in North Carolina*. Better Crops with Plant Food. April, 1944.
16. Etchells, J. L., and Jones, I. D. *Preservation of Vegetables by Salting or Brining*. USDA Farmers Bul. 1932. (Revised 1944.)

17. Forster, G. W., et al. *North Carolina State Report on Agricultural War-time Production*. (Mimeographed.) July, 1944.
18. Forster, G. W., et al. *North Carolina State Report on Production Adjustments in Agriculture*. (Mimeographed.) December, 1944.
19. Forster, G. W., et al. *Postwar Planning for North Carolina Agriculture*. Reports No. 1, Postwar Planning for Agriculture; No. 4, The Conservation and Development of Crop and Pasture Lands in North Carolina; No. 6, Our Forest Lands and Their Development; No. 8, Marketing Facilities—Fruits and Vegetables; No. 9, Rural Electrification. (Mimeographed.) 1944.
20. Greene, R. E. L. *Production and Cost in North Carolina: Cabbage, Cantaloupes, Cucumbers, Green Peas, Lima Beans, Peppers, Snap Beans, Squash, Tomatoes, Watermelons*. (Mimeographed report for each.) 1944.
21. Greene, R. E. L., James, H. Brooks, and Peterson, M. J. *An Economic Review of Long-Staple Cotton Production Possibilities in the Southeast*. (Mimeographed.) 1944.
22. Hamilton, C. Horace. *Elements of a State Medical Care Plan*. (Mimeographed.) 1944.
23. Hamilton, C. Horace. *Farm Population Changes in North Carolina*. Progress Report No. RS-2. (Mimeographed.) April, 1944.
24. Hamilton, C. Horace. *Medical Care Needs and Plans for Rural People in North Carolina*. (Mimeographed.) July, 1944.
25. Hamilton, C. Horace. *Planning for Rural Medical and Hospital Care*. Farmers Federation News. August, 1944.
26. Hamilton, C. Horace, and Committee. *Medical Care and Hospital Facilities for Rural People in North Carolina*. (Mimeographed.) October, 1944.
27. Hamilton, C. Horace, and members of the Department of Rural Sociology. *Medical Care Services in North Carolina: A Statistical and Graphic Summary*. Progress Report RS-4. (Mimeographed.) December, 1944.
28. Hendricks, Walter A., and Bell, Hugh P. *Estimating State Totals from Sample County Totals*. Bur. Ag. Ec. USDA. (Mimeographed.) 1944.
29. McLean, L. G. *Yule Decorations from the Nursery*. Amer. Nurseryman. 1944.
30. Mayo, Selz C. *The Foreign-Born White Population in North Carolina*. Progress Report RS-3. (Mimeographed.) 1944.
31. Middleton, G. K., Schultz, E. F., Jr., Colwell, W. E., and Brady, N. C. *Report on Peanut Experiments Involving Variety-Fertility Combinations Conducted in 1943*. Agron. Inf. Circ. 135. (Lithographed.) March, 1944.
32. Moore, R. P. *Results of 1944 Official Variety Tests in North Carolina—Wheat - Oats - Barley*. Agron. Inf. Circ. 136. (Lithographed.) July, 1944.
33. Peterson, W. J., Brady, D. E., and Shaw, A. O. *The Thiamine Content of Pork Loin Muscles and the Retention During Cooking*. National Cooperative Project on the Conservation of Nutritive Value of Foods. Progress Note No. V. (Mimeographed.) February, 1944.
34. Peterson, W. J., Halverson, J. O., Sherwood, F. W., and Baxley, H. *The Riboflavin Content of Cowpeas, Soybeans and Peanuts*. National Cooperative Project on the Conservation of Nutritive Value of Foods. Progress Note No. VI. (Mimeographed.) August, 1944.
35. Peterson, W. J., et al. *Cooking Losses at Army and Navy Training Camps at Land Grant Institutions*. National Cooperative Project on the Conserva-

- tion of Nutritive Value of Foods. Southern Cooperative Series, Progress Report No. 8. (Mimeographed.) April 15, 1944.
36. Peterson, W. J., et al. *Cooking Losses at Army and Navy Training Camps at Land Grant Institutions*. National Cooperative Project on the Conservation of Nutritive Value of Foods. Southern Cooperative Series, Progress Report No. 9. (Mimeographed.) June 30, 1944.
 37. Rankin, W. H. *Small Grains Respond to Fertilizers*. Agron. Inf. Circ. No. 137. (Lithographed.) 1944.
 38. Reed, J. F. *Soil Tests Indicate Potash Levels*. Better Crops with Plant Food. June, 1944.
 39. Smith, Clyde F. *The Aphidiinae of North America*. The Ohio State University Press. 157 pp. 1944.
 40. Smith, Clyde F. *Peach Insect Control*. Proceedings Southern War Conference on Entomology 18th Annual Meeting. pp. 63-67. 1944.
 41. Smith, T. E. *Control of Bacterial Wilt (*Bacterium solanacearum*) of Tobacco as Influenced by Crop Rotation and Chemical Treatment of the Soil*. USDA Circ. 692. 1944.
 42. Smith, T. E. *Status of Tobacco Black Shank in North Carolina*. Plant Disease Reporter 28:159. 1944.

SCIENTIFIC JOURNAL ARTICLES

1. Biswell, H. H., Foster, J. E., and Southwell, B. L. *Grazing in Cut-Over Pine Forests of the Southeast*. Jour. Forestry 42:195-198. 1944.
2. Brady, D. E., Peterson, W. J., and Shaw, A. O. *Riboflavin and Thiamine Contents of Pork Loin Muscles and Their Retention During Cooking*. Food Res. 9:400-405. 1944.
3. Brady, D. E., Peterson, W. J., and Shaw, A. O. *Riboflavin Content of Beef*. Food Res. 9:406-409. 1944.
4. Brady, D. E., Smith, F. H., and Comstock, R. E. *Rancidity Control in Cured Meats*. Jour. Anim. Sci. 4:443. (Abst.) 1944.
5. Clayton, E. E., Shaw, K. J., Smith, T. E., Gaines, J. G., and Graham, T. W. *Tobacco Disease Control by Crop Rotation*. Phytopathology 34:870-883. 1944.
6. Comstock, R. E., and Winters, L. M. *A Comparison of the Effects of Inbreeding and Selection on Performance in Swine*. Jour. Anim. Sci. 3:380-389. 1944.
7. Comstock, R. E., and Winters, L. M. *The Development of Body Form in Swine*. Jour. Anim. Sci. 3:188-193. 1944.
8. Comstock, R. E., Winters, L. M., and Cummings, John N. *The Effect of Sex on the Development of the Pig. III. Differences in Growth Rate Between Gilts and Barrows by Lines of Breeding*. Jour. Anim. Sci. 3:120-128. 1944.
9. Cox, Gertrude M. *Modernized Field Designs at Rothamsted*. Soil Sci. Soc. Proceedings 8:20-22. 1944.
10. Cox, Gertrude M. *Statistics as a Tool for Research*. Jour. Home Econ. 36:575-580. 1944.
11. Etchells, J. L., and Jones, I. D. *The Importance of Care in the Pasteurization of Pickle Products*. The Canner 98:28, 64. 1944.
12. Etchells, J. L., and Jones, I. D. *Procedure for Pasteurization of Pickle Products*. The Glass Packer 28:519-523, 546. 1944.
13. Forster, G. W. *Some Defects in the Analysis of Farm Management Data*.

- Jour. of Farm Economics 26:775-779. 1944.
14. Foster, J. E., Biswell, H. H., and Hostetler, E. H. *Comparison of Different Amounts of Protein Supplement for Wintering Beef Cows on Forest Range in the Southeastern Coastal Plain*. Jour. Anim. Sci. 3:436. (Abst.) 1944.
 15. Hamilton, C. Horace. *Comparing Two Questionnaire Surveys of Farm Population*. Rural Sociology 9:1. March, 1944.
 16. Hamilton, C. Horace. *Review of Hagood's Rural Level of Living Indexes for Counties of the United States, 1940*. Rural Sociology 9:2. June, 1944.
 17. Hamilton, C. Horace, and Henderson, Francis M. *Use of the Survival Rate Method in Measuring Net Migration*. Journal of the American Statistical Ass'n. 39. 1944.
 18. Hendricks, Walter A. *Relative Efficiencies of Groups of Farms as Sampling Units*. Jour. Amer. Stat. Ass'n. 39:366-376. 1944.
 19. Jones, I. D., and Etchells, J. L. *Nutritive Value of Brined and Fermented Vegetables*. Amer. Journ. Pub. Health 34:711-718. 1944.
 20. Kerr, Thomas, and Anderson, D. B. *Osmotic Quantities in Growing Cotton Bolls*. Plant Physiology 19:338-349. 1944.
 21. Lovvorn, R. L. *The Effects of Fertilization, Species Competition and Cutting Treatments on the Behavior of Dallis Grass (Paspalum Dilatatum Poir.) and Carpet Grass (Axonopus Affinis Chase)*. Jour. Amer. Soc. Agron. 36:590-600. 1944.
 22. Lovvorn, R. L. *The Influence of Lespedeza and Fertilizer Treatment on the Behavior of Dallis Grass, Carpet Grass, and Bermuda Grass*. Jour. Amer. Soc. Agron. 36:791-802. 1944.
 23. Mehlich, A., and Colwell, W. E. *Influence of Nature of Soil Colloids and Degree of Base Saturation on Growth and Nutrient Uptake by Cotton and Soybeans*. Soil Sci. Soc. Amer. Proc. 8:179-184. 1944.
 24. Middleton, G. K., and McMillen, R. W. *Winter Survival of Rough- and Smooth-Awned Barleys*. Jour. Am. Soc. Agron. 36:626-627. 1944.
 25. Nelson, W. L., and Brady, N. C. *Effect of Subsurface Application of Lime on Yield, Scab and Nutrient Uptake of Irish Potatoes*. Soil Sci. Soc. Amer. Proc. 8:313-316. 1944.
 26. Nordskog, A. W., Comstock, R. E., and Winters, L. M. *Hereditary and Environmental Factors Affecting Growth Rate in Swine*. Jour. Anim. Sci. 3:257-272. 1944.
 27. Nordskog, A. W., Comstock, R. E., and Winters, L. M. *The Relationship Between Certain Blood Components and Rate of Growth in Swine*. Jour. Anim. Sci. 3:422-430. 1944.
 28. Peterson, W. J., Haig, F. M., and Shaw, A. O. *Destruction of Riboflavin in Milk by Sunlight*. Amer. Chem. Soc. Jour. 66:662. 1944.
 29. Schumacher, A. E., Scott, H. M., Hughes, J. S., and Peterson, W. J. *The Role of Carotenols in Growth and Reproduction in the Fowl*. Poultry Sci. 23:529-532. 1944.
 30. Sherwood, F. W., Comstock, R. E., and Halverson, J. O. *The Riboflavin Content of Soybeans as Determined by the Rat Growth Method in a Lattice Square Design*. Jour. Anim. Sci. 3:448. (Abst.) 1944.
 31. Stitt, R. E. *Effect of Moisture, Seeding Dates, and Fertilizer on Stands and Yields of Crimson Clover*. Jour. Amer. Soc. Agron. 36:464-467. 1944.
 32. Woodhouse, W. W., Jr. *Some Factors Affecting Pasture Production in Western North Carolina*. Jour. Amer. Soc. Agron. 36:993. 1944.

OFFICERS AND STAFF

of the

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

December 1, 1944

ADMINISTRATION

L. D. BAVER, Ph.D.	<i>Director</i>
NETTIE D. HAYWOOD, A.B.	<i>Secretary</i>
F. H. JETER, B.S.	<i>Editor</i>
MRS. L. B. JUDD	<i>Clerk</i>
F. E. MILLER, B.S.	<i>Director of Branch Stations</i>
J. G. VANN, B.S.	<i>Assistant Controller</i>
PHYLLIS YATES, A.B.	<i>Assistant Editor</i>

AGRICULTURAL ECONOMICS

G. W. FORSTER, Ph.D.	<i>Head of Department</i>
J. M. BACHEMIN, B.S.	<i>Assistant</i>
R. E. L. GREENE, Ph.D.	<i>Associate, Farm Management</i>
H. BROOKS JAMES, M.S.	<i>Associate</i>
B. W. KENYON, M.S.	<i>Assistant</i>

AGRICULTURAL ENGINEERING

D. S. WEAVER, M.S.	<i>Head of Department</i>
G. W. GILES, M.S.	<i>Associate, Farm Machinery</i>
J. W. WEAVER, B.S.	<i>Associate</i>

AGRONOMY

R. W. CUMMINGS, Ph.D.	<i>Head of Department</i>
L. S. BENNETT, Ph.D.	<i>Assistant, Seed Improvement</i>
L. F. BURKHART, Ph.D.	<i>Assistant, Soil Fertility</i>
D. S. CHAMBLEE, B.S.	<i>Assistant, Forage Crops</i>
E. R. COLLINS, Ph.D.	<i>Associate, Soil Fertility</i>
T. L. COPLEY, M.S.	<i>Associate, In Charge, Soil Conservation</i>
L. A. FORREST, M.S.	<i>Assistant, Soil Conservation</i>
LEAH FLEMING, A.B.	<i>Laboratory Technician</i>
E. F. GOLDSTON, B.S.	<i>Assistant, Soil Survey</i>
MRS. RUTH MONTGOMERY	<i>Laboratory Technician</i>
W. C. GREGORY, Ph.D.	<i>Associate, Corn Breeding</i>
E. E. HARTWIG, Ph.D.	<i>Associate, Forage Crops</i>
P. H. HARVEY, Ph.D.	<i>Associate, In Charge, Corn Breeding</i>
THOS. KERR, Ph.D.	<i>Associate, Cotton Technology</i>
P. H. KIME, M.S.	<i>Associate, Cotton Breeding</i>
B. A. KRANTZ, Ph.D.	<i>Assistant, Soil Fertility</i>
W. D. LEE, B.S.	<i>Associate, In Charge, Soil Survey</i>
R. A. LINEBERRY, Ph.D.	<i>Assistant, Soil Fertility</i>
R. L. LOVVORN, Ph.D.	<i>Associate, In Charge, Forage Crops</i>
J. F. LUTZ, Ph.D.	<i>Associate, Soils</i>
R. W. McMILLEN, M.S.	<i>Assistant, Small Grain Breeding</i>

ELLEN MADDREY, A.B.	Laboratory Technician
ADOLF MEHLICH, Ph.D.	Associate, Soil Chemistry
G. K. MIDDLETON, Ph.D.	Associate, Head, Field Crops Section
J. H. MOORE, Ph.D.	Associate, Cotton Technology
R. P. MOORE, Ph.D.	Associate, Seed Improvement
¹ E. G. MOSS, B.S.	Associate, In Charge, Tobacco Investigations, Oxford, N. C.
W. L. NELSON, Ph.D.	Assistant, Soil Fertility
ELIZABETH B. PHELPS, B.S.	Laboratory Technician
J. R. PILAND, M.S.	Assistant, Soil Chemistry
W. H. RANKIN, M.S.	Associate, Soil Fertility
J. F. REED, Ph.D.	Associate, Soil Chemistry
J. A. RIGNEY, M.S.	Associate, Forage Crops
GLENN ROBINSON, B.S.	Assistant, Soil Survey
B. W. SMITH, Ph.D.	Assistant, Forage Crop Breeding
LOIS STEVENSON	Laboratory Assistant
¹ R. E. STITT, Ph.D.	Assistant, Forage Crops, Statesville, N. C.
A. D. STUART, M.S.	Associate, Seed Improvement
¹ R. H. TILLEY, B.S.	Assistant, Cotton Breeding, Statesville, N. C.
C. B. WILLIAMS, M.S.	Agronomist
¹ W. W. WOODHOUSE, JR., M.S.	Associate, Soil Fertility

ANIMAL INDUSTRY

J. H. HILTON, M.S.	Head of Department
J. A. AMMERMAN, B.S.	Assistant, Animal Husbandry
HARTLEE M. BAXLEY, B.S.	Laboratory Technician
D. E. BRADY, Ph.D.	Associate, In Charge, Meats Research
R. E. COMSTOCK, Ph.D.	Associate, In Charge, Genetics Research
³ E. W. FAIRES, B.S.	Assistant, Dairy Section, Willard, N. C.
³ J. E. FOSTER, Ph.D.	Associate, In Charge, Beef Cattle and Sheep Research
C. D. GRINNELLS, D.V.M., M.S.	Associate, Head, Dairy Section
J. O. HALVERSON, Ph.D.	Associate, Animal Nutrition
² E. H. HOSTETLER, M.S.	Associate, Head, Animal Husbandry Section
MRS. SYLVIA LOWENBERG, A.B.	Laboratory Technician
J. L. MOORE, M.S.	Assistant, Dairy Section
W. J. PETERSON, Ph.D.	Associate, Head, Nutrition Section
W. M. ROBERTS, M.S.	Associate, Dairy Manufacture
F. W. SHERWOOD, Ph.D.	Associate, Nutrition
F. H. SMITH, M.S.	Assistant, Nutrition
NELSON TUCKER, A.B.	Laboratory Technician
VIRGINIA WELDON, A.B.	Laboratory Technician

BOTANY

B. W. WELLS, Ph.D.	Head of Department
D. E. ELLIS, M.S.	Assistant, Vegetable Diseases
B. R. ELLISON, M.S.	Assistant
J. H. JENSEN, Ph.D.	Associate, In Charge, Plant Pathology
S. G. LEHMAN, Ph.D.	Associate, Cotton Diseases
¹ T. E. SMITH, Ph.D.	Associate, Tobacco Diseases, Oxford, N. C.

EXPERIMENTAL - STATISTICS

GERTRUDE M. COX, M.S.	Head of Department
R. E. COMSTOCK, Ph.D.	Associate, Animal Science Statistics

*W. A. HENDRICKS, M.A.	<i>Agricultural Statistics</i>
VIRGINIA MONTAGUE, A.B.	<i>Assistant</i>
J. A. RIGNEY, M.S.	<i>Associate, Plant Science Statistics</i>
*GLEN F. VOGEL, B.A.	<i>Agricultural Statistician</i>

FORESTRY

J. V. HOFMANN, Ph.D.	<i>Head of Department</i>
CLEMENS KAUFMAN, Ph.D.	<i>Assistant</i>
J. M. STINGLEY, B.S.	<i>Assistant</i>

HORTICULTURE

M. E. GARDNER, B.S.	<i>Head of Department</i>
¹ CHAS. T. DEARING, B.S.	<i>Associate, Grape Investigations, Willard, N. C.</i>
⁴ J. L. ETHELLE, Ph.D.	<i>Associate, Bacteriology</i>
ELEANOR GIBBS, A.B.	<i>Laboratory Technician</i>
IVAN D. JONES, Ph.D.	<i>Associate, Biochemistry</i>
L. G. MCLEAN, M.S.	<i>Associate, Flowers and Nursery</i>
E. B. MORROW, M.S.	<i>Associate, Small Fruits</i>
G. O. RANDALL, M.S.	<i>Associate</i>
C. E. VANDEMAN, B.S.	<i>Assistant, Pomology</i>
OTTO VEERHOFF, Ph.D.	<i>Associate, Physiology</i>
J. G. WEAVER, M.S.	<i>Associate</i>
C. F. WILLIAMS, M.S.	<i>Associate, Small Fruits</i>

POULTRY

R. S. DEARSTYNE, M.S.	<i>Head of Department</i>
C. H. BOSTIAN, Ph.D.	<i>Associate, Genetics</i>
H. C. GAUGER, M.S.	<i>Associate, Bacteriology</i>
R. E. GREAVES, M.S.	<i>Assistant, Serology</i>
W. B. NESBIT, B.S.	<i>Assistant, Turkey Research</i>

RURAL SOCIOLOGY

C. HORACE HAMILTON, Ph.D.	<i>Head of Department</i>
M. R. CHAMBERS, A.B.	<i>Assistant</i>
S. C. MAYO, Ph.D.	<i>Assistant, Community Organization</i>

ZOOLOGY AND ENTOMOLOGY

Z. P. METCALF, D.Sc.	<i>Head of Department</i>
B. B. FULTON, Ph.D.	<i>Associate, Entomology</i>
W. M. KULASH, Ph.D.	<i>Assistant, Entomology</i>
C. F. SMITH, Ph.D.	<i>Associate, Entomology</i>

APPLE RESEARCH LABORATORY, NORTH WILKESBORO

C. E. VAN DEMAN, B.S.	<i>Associate in Horticulture, In Charge</i>
-----------------------	---

PEACH RESEARCH LABORATORY, EAGLE SPRINGS

EDGAR GRAHAM	<i>Foreman</i>
--------------	----------------

SOIL RESEARCH LABORATORY, WILMINGTON

L. G. WILLIS, M.S.	<i>Director, In Charge</i>
--------------------	----------------------------

CENTRAL STATION

R. J. HARRIS.....	<i>Assistant Director in Charge</i>
J. P. AMMERMAN, JR.....	<i>Foreman, Animal Husbandry</i>
N. L. JOHNSON.....	<i>Herdsman, Animal Husbandry</i>
L. Y. PARKER.....	<i>Foreman</i>
E. A. MELIN.....	<i>Herdsman, Dairy</i>

DAIRY RESEARCH FARM, STATESVILLE

B. F. MILLS.....	<i>Foreman</i>
------------------	----------------

McCULLERS BRANCH STATION

J. L. RAND, A.B.....	<i>Assistant Director In Charge</i>
⁵ SOIL CONSERVATION EXPERIMENT STATION (NEAR RALEIGH)	
T. L. COPLEY, M.S.....	<i>Project Supervisor</i>
LUKE A. FORREST, M.S.....	<i>Assistant Soil Conservationist</i>
M. T. AUGUSTINE, B.S.....	<i>Project Engineer</i>
J. O. KNOTT.....	<i>Farm Foreman</i>

BRANCH STATIONS†

TIDEWATER BRANCH STATION, PLYMOUTH

² J. L. REA, JR., B.S., M.Agr.....	<i>Assistant Director In Charge</i>
HERBERT ALLEN	<i>Foreman</i>
² DEMPSEY ALLEN	<i>Herdsman</i>

LOWER COASTAL PLAIN BRANCH STATION, WILLARD

¹ CHAS. T. DEARING, B.S.....	<i>Assistant Director In Charge</i>
J. GORDON BLAKE, B.S.....	<i>Assistant Superintendent</i>
C. O. BOLLINGERL.....	<i>Poultryman</i>
³ E. W. FAIRES, B.S....	<i>Assistant, Dairying, Bureau of Dairy Industry, USDA</i>

MOUNTAIN BRANCH STATION, WAYNESVILLE

DEAN W. COLVARD, M.S.....	<i>Assistant Director In Charge</i>
J. E. LOVE	<i>Poultryman</i>
W. M. WHISENHUNT.....	<i>Foreman</i>

PIEDMONT BRANCH STATION, STATESVILLE

¹ J. W. HENDRICKS, B.S.....	<i>Assistant Director In Charge</i>
¹ R. H. TILLEY, B.S.....	<i>Assistant, Cotton Breeding, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA</i>

TOBACCO BRANCH STATION, OXFORD

¹ E. G. MOSS, B.S.....	<i>Assistant Director In Charge</i>
¹ T. E. SMITH, Ph.D.....	<i>Associate, Tobacco Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA</i>

UPPER COASTAL PLAIN BRANCH STATION, ROCKY MOUNT

R. E. CURRIN, JR.....	<i>Assistant Director In Charge</i>
WM. ALLSBROOK	<i>Foreman</i>

† The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

¹ In cooperation with Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.

² In cooperation with Bureau of Animal Industry, U.S.D.A.

³ In cooperation with Bureau of Dairy Industry, U.S.D.A.

⁴ In cooperation with Bureau of Agricultural and Industrial Chemistry, U.S.D.A.

⁵ In cooperation with Soil Conservation Service, U.S.D.A.

⁶ In cooperation with Bureau of Agricultural Economics, U.S.D.A.

⁷ In cooperation with Tennessee Valley Authority.

FINANCIAL REPORT

of the

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
FOR THE YEAR ENDED JUNE 30, 1944

CERTIFICATION

We, the undersigned, certify that the receipts and expenditures shown in this report from Federal funds and as offset to Bankhead-Jones funds are correct; that the expenditures were solely for the purposes set forth in the acts of Congress approved March 2, 1887 (Hatch), March 16, 1906 (Adams), February 24, 1925 (Purnell), May 16, 1928 (Hawaii), February 23, 1929 (Alaska), March 4, 1931 (Puerto Rico), June 29, 1935 (Bankhead-Jones, Title I), June 20, 1936 (Alaska), and March 4, 1940 (Employer Contributions to Retirement); that the expenditures are in accordance with the terms of said acts so far as applicable to this station; and that properly approved vouchers are on file for all expenditures.

We further certify that the sum of \$ None was the total amount earned as interest on the deposit of Hatch, Adams, Purnell, and Bankhead-Jones funds and that this amount has been remitted to the Treasurer of the United States through the United States Department of Agriculture.

(Signed) L. D. BAVER,
Director of Experiment Station

(Signed) J. G. VANN,
(Legal custodian of Federal funds)
Assistant Controller

Title North Carolina State College of
Agriculture and Engineering

(Seal of Institution)

RECEIPTS AND EXPENDITURES

**UNDER HATCH, ADAMS, PURNELL, AND BANKHEAD-JONES ACTS,
AND THE STATE OFFSET REQUIRED BY THE BANKHEAD-JONES ACT**

Fiscal Year Ended June 30, 1944

RECEIPTS

	Balance from 1943	Receipts from U. S. Treasury	Total
FEDERAL FUNDS:			
Hatch	None	\$ 15,000.00	\$ 15,000.00
Adams	None	15,000.00	15,000.00
Purnell	None	60,000.00	60,000.00
Bankhead-Jones	None	106,085.56	106,085.56
FOR BANKHEAD-JONES OFFSET ..			249,183.62

EXPENDITURES

PURPOSE	FUND			
	Hatch	Adams	Purnell	Bankhead-Jones
Personal services:				
Administration	\$12,680.00			
For all other purposes		\$13,078.83	\$49,601.28	\$ 87,143.06
Travel	1,064.85	449.05	3,734.50	5,656.27
Transportation of Things	8.64	20.57	3.36	232.01
Communication Service	140.46	5.38	230.13	403.30
Rents and Utility Services:				
Heat, light, power, water, gas, electricity			22.35	120.16
Rent of space in buildings or equipment			700.00	52.62
Rent of land				694.00
Printing and Binding:				
Printing publications	21.79		648.26	
Other printing, and binding	712.10		53.31	39.75
Other Contractual Services	18.83	304.86	405.11	784.61
Supplies and Materials:				
Used in construction, repair, or alteration of buildings		7.10		198.90
Other supplies and materials	32.78	904.91	3,890.26	7,620.43
Equipment	320.55	229.30	711.44	3,059.45
Buildings and fixed equipment				81.00
TOTAL EXPENDITURES	\$15,000.00	\$15,000.00	\$60,000.00	\$106,085.56

BANKHEAD-JONES OFFSET, TOTAL APPROVED EXPENDITURES \$249,183.62

NON-FEDERAL FUNDS

Fiscal Year Ended June 30, 1944

FUNDS AVAILABLE

	For All Purposes	For Agricultural Investigations
State appropriations or allotments:		
Main station	\$184,420.93	\$175,630.62
Sales	40,891.31	40,891.31
Miscellaneous: Commercial Gifts	17,079.74	17,079.74
Balance brought forward from previous year	15,581.95	15,581.95
(All sources)		
TOTAL.....	\$257,973.93	\$249,183.62

CLASSIFICATION OF EXPENDITURES FOR AGRICULTURAL INVESTIGATIONS

Personal Services	\$146,345.85
Travel	10,634.48
Transportation of Things	728.75
Communication Service	2,154.62
Rents and Utility Services	3,627.73
Printing and Binding	2,945.61
Other Contractual Services	7,460.54
Supplies and Materials	38,639.19
Equipment	16,007.11
Lands and Structures (Contractual)	4,469.52
TOTAL EXPENDITURES	\$233,013.40
Unexpended balance	16,170.22
TOTAL FUNDS AVAILABLE	\$249,183.62

STATE LIBRARY OF NORTH CAROLINA



3 3091 00748 6079

THE AGRICULTURAL EXPERIMENT STATION
OF THE
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
AND
NORTH CAROLINA DEPARTMENT OF AGRICULTURE, COOPERATING
L. D. BAVER, DIRECTOR
STATE COLLEGE STATION
RALEIGH